Archaeological Investigations At Tosawihi, A Great Basin Quarry

Part 7: 26EK5040,
A Middle Archaic Reduction Station and Campsite

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ABSTRACT

Archaeological excavations at 26Ek5040, in north central Nevada, revealed a workshop/campsite where prehistoric inhabitants concentrated on the manufacture of bifaces made of high quality opalite toolstone abundant in the nearby Tosawihi Quarries. 26Ek5040 lies within the "Tosawihi Production Sphere" (Leach and Botkin 1992), a more than 125 square kilometer area around the quarries within which most prehistoric activity focused on tool manufacture. The site is notable principally for its chronological context. In contrast to the bulk of occupation of the Tosawihi Quarries, where most sites contain mixed Middle and Late Archaic deposits, and where use intensified in the Late Archaic, 26Ek5040 dates primarily to the Middle Archaic. Excavations at 26Ek5040 suggest that biface technology became more standardized from the Middle to the Late Archaic. In earlier times, visits to the area may have been of longer duration or composed of larger groups than in the Late Archaic. In contrast with the Late Archaic pattern, finished bifaces were exported in addition to partially finished tools. Analyses of obsidian from 26Ek5040 suggest the possibility of a territorial boundary along the Humboldt River south of Tosawihi which may have controlled access to the quarries over a long period of time.

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Acknowledgements

Seventh in a series reporting archaeological research at the Tosawihi Quarries, the work described herein was performed under contract to Newmont Exploration, Ltd.; Rick Lisle served as our liaison with Newmont; we thank him for his assistance. Kathryn Ataman served as Principal Investigator, designing and supervising the research. Margaret Bullock served as crew chief. Geomorphological investigations were conducted by Dan Dugas and site mapping by Bryan Cooperrider. The field crew consisted of Janette Benjamin, Bryan Cooperrider, Jim Carter, Tim Hunt, Susan McCabe, and Molly O'Halloran.

Robert G. Elston provided editorial support. Graphics and maps were prepared by Molly O'Halloran. Artifact photographics were crafted by Janette Benjamin. Report production was accomplished by Kathy Nickerson.

INTRODUCTION

A decade of minerals exploration and development on BLM-administered lands within the Ivanhoe Mining District of Elko County, Nevada (Figure 1), has produced a considerable body of research concerning the cultural resources of this region. The prehistory of the area is tied closely to the exploitation and manipulation of opalite toolstone from the Tosawihi Quarries (Figure 2), which are notable among Great Basin archaeological sites in general, and among quarry sites in particular, for their sheer extent and abundance of archaeological material. While artifacts that point to residential occupation are relatively rare at quarry localities, evidence of non-quarrying land use is apparent at Tosawihi. Evidence of Pre-Archaic hunting in the heart of the Quarries and multi-component campsites on their periphery attest to at least periodic non-quarrying use of the area. Rockshelters and other localities within the Quarries are potential informants of problem domains other than those associated with prehistoric lithic procurement.

The present report is the seventh volume in a series reporting archaeological investigations in the vicinity of Tosawihi Quarries. All have been undertaken in association with The Ivanhoe Project, first proposed by Ivanhoe Gold Company and now continued by Newmont Gold Corporation.

History of Investigations

Development of the pit, processing plant, and ancillary facilities of the Ivanhoe/Hollister Mine encompassed areas to the west and east of the 800+ acre Tosawihi Quarries 26Ek3032, i.e., the Western and Eastern Peripheries (Figure 3). The Silver Cloud Road, which links the mine and ancillary facilities to roads along Antelope Creek leading to Battle Mountain, was upgraded to handle traffic associated with mine development and, in 1991, a previously unsurveyed segment of Silver Cloud Road, traversing BLM-administered land (Elko District), sustained unauthorized heavy equipment blading. At the request of Ivanhoe Gold Company, Intermountain Research inventoried the segment of road where blading had occurred in order to assess effects to significant cultural resources (IMR Project 637-004; BLM CrNV-1-1449).

Fifteen previously unrecorded sites were discovered by the inventory. Of these, fourteen were considered ineligible for nomination to the National Register of Historic Places. However, one (26Ek5040) demonstrated potential for intact subsurface cultural deposits and potential to contribute to an understanding of the Tosawihi Quarries vicinity. Site testing was recommended.

Under the stipulations of an agreement between the BLM Elko District Office and Ivanhoe Mining Company, Intermountain Research conducted an archaeological evaluation of 26Ek5040 in April 1992 (IMR Project 638-5040). Based on results of this evaluation (Ataman et al. 1992), BLM determined the site eligible for National Register consideration and the Nevada State Historic Preservation Officer concurred. The same agreement committed Ivanhoe Gold Company to mitigate the effects of blading on the site, an obligation subsequently assumed by Newmont.

The following report documents the excavation and analysis of 26Ek5040. The report describes the environmental setting of the site and surrounding area, reviews regional ethnographic information, summarizes previous archaeological investigations conducted in the immediate area, describes results of the data recovery, and reviews the findings in a regional context. Much of the background material presented herein is derived from *An Archaeological Evaluation of Site 26Ek5040* (Ataman et al. 1992) and the data recovery plan (Intermountain Research 1994) developed to guide the work.

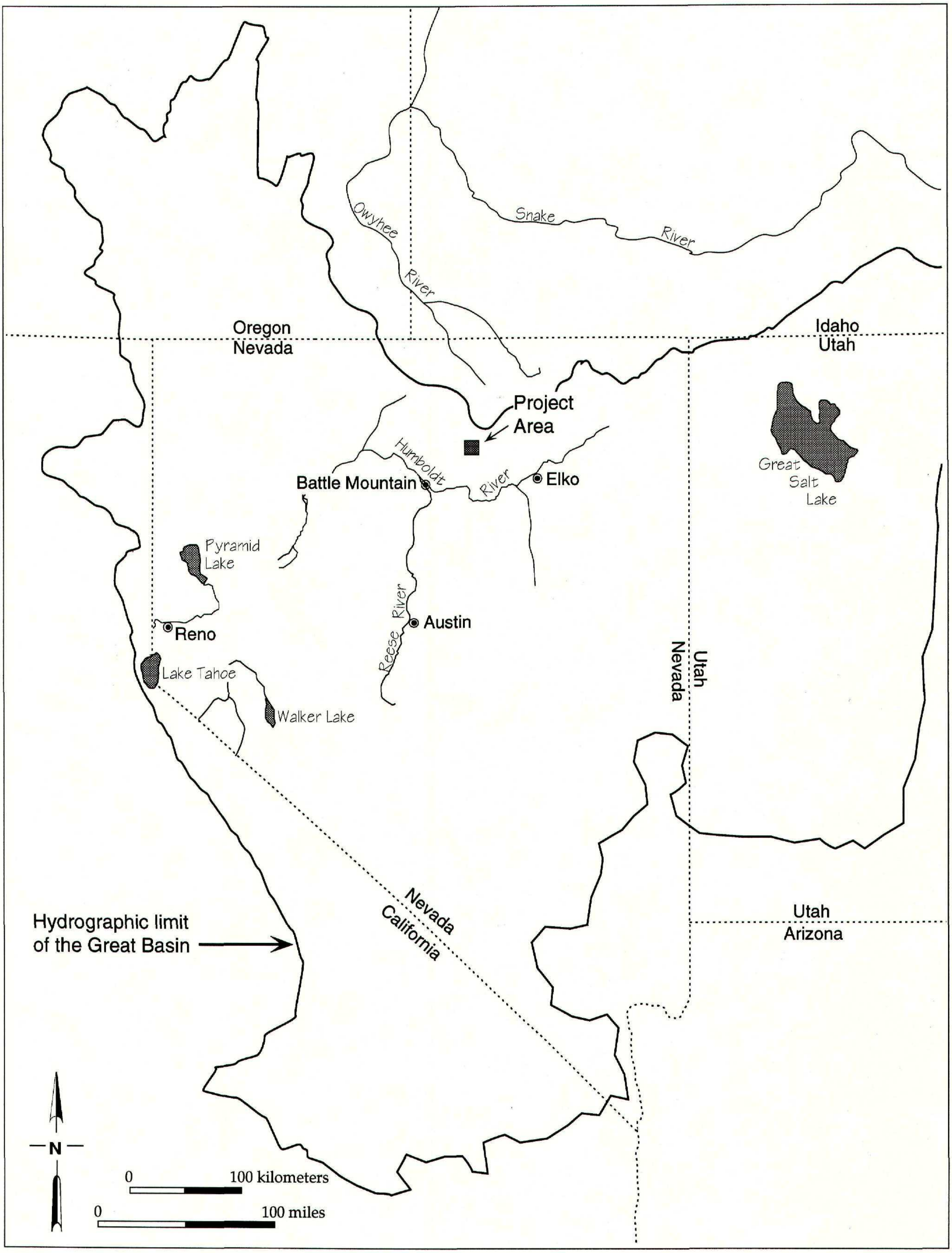

Figure 1. Project location map.

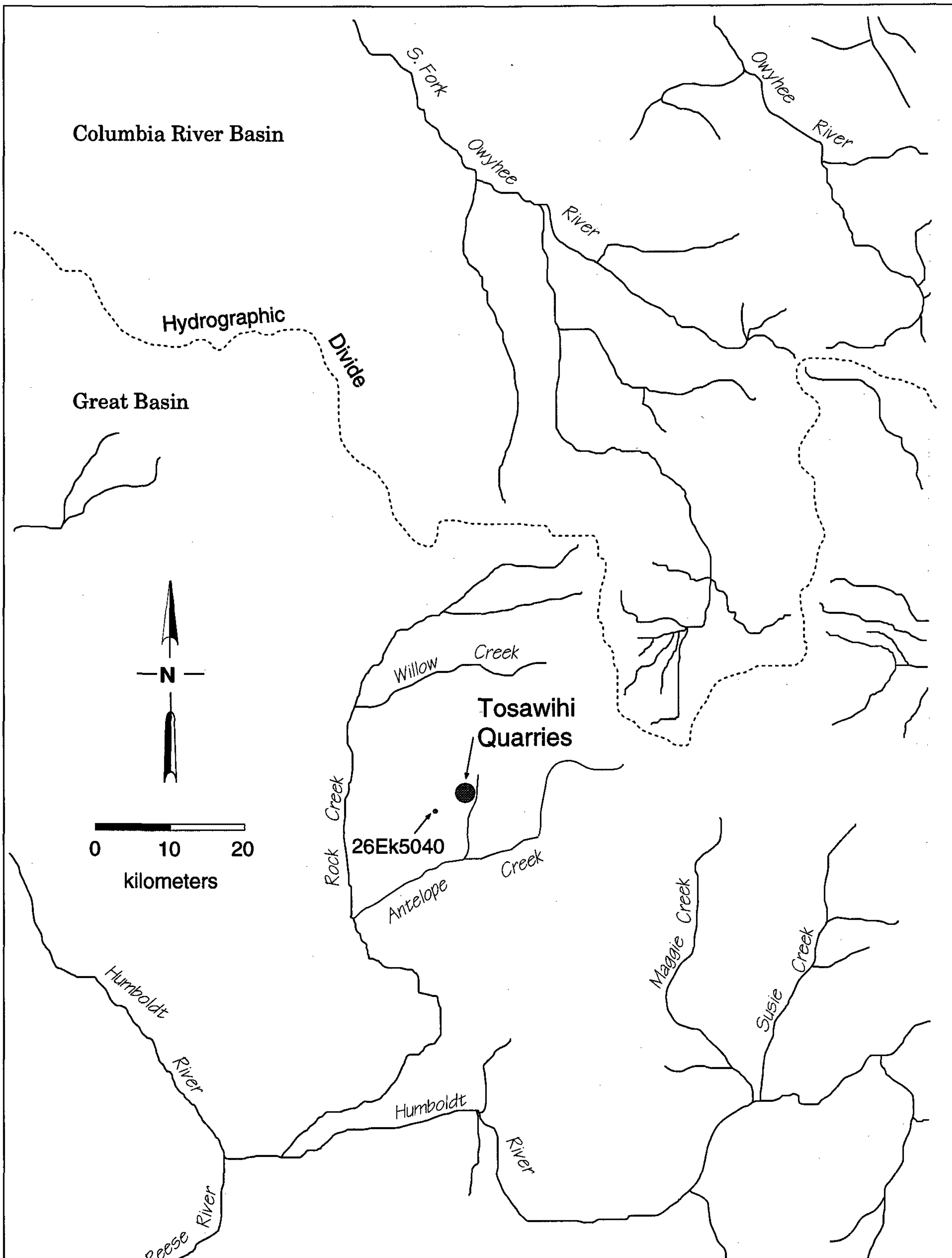

Figure 2. Tosawihi Quarries (26Ek3032) and 26Ek5040 in their regional setting.

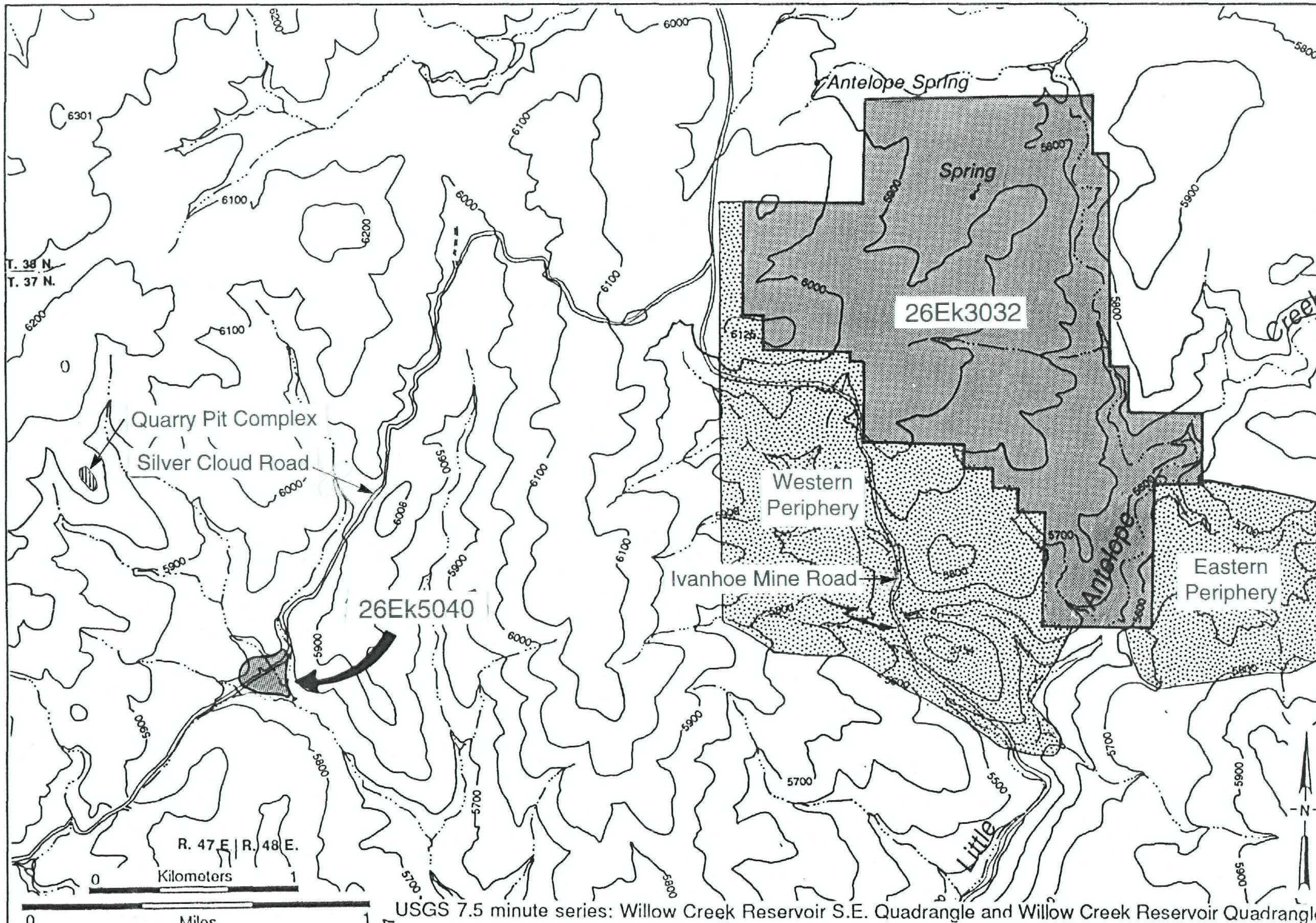

Figure 3. Site 26Ek5040 in relation to the Tosawihi Quarries (26Ek3032).

Chapter 1

RESEARCH OBJECTIVES AND CONTEXTS

Kathryn Ataman, Editor

26Ek5040 lies in the northern extreme of the Sheep Creek Range, a mid-elevation upland (4500-7500 ft amsl) that rises from the floodplain of the Humboldt River and abuts the higher north-south sweep of the Tuscarora Mountains. Environmental attributes of the region, including its geology, topography, hydrology, flora, and fauna, have been summarized variously by Raven (1987, 1992), Budy, Elston, and Raven (1989), and Leach and Botkin (1992); they are not reiterated here save as they pertain to the immediate setting of 26Ek5040.

The following descriptions of physical and cultural settings are taken directly from Raven (1992), with minor modification.

Physical Setting

The site covers an area of just under 33,000 m^2 occupying a group of alluvial terraces cut by three small confluent ephemeral stream channels in uneven terrain at 5500 to 6300 ft amsl (Figures 4, 5). Basalts and rhyolites dominate local bedrock, although zones of silicification have been noted nearby (Leach and Botkin 1992). Three channels drain small canyons immediately upslope (west and north); their confluences fall within and adjacent the site vicinity, from which runoff follows a single channel down to Antelope Creek some 7.5 km southeast. Although the confluence of drainages may have rendered the locus of 26Ek5040 somewhat more attractive than most of the otherwise poorly watered vicinity, the site lies at the base of a watershed no larger than 3.5 km^2. Runoff is rapid, and significant flows in any channel probably occur only during snow melt or coincident with substantial thunder showers. Two km southeast of the site a mapped spring feeds into the principal runoff channel, and approximately 1 km southeast in the same channel an unmapped spring/seep was active into mid-June after the very dry winter of 1993/1994. No other water sources are mapped in the surrounding 50 km^2, although a low area in the site itself and another drainage to the west of the site, dammed for livestock, contain water into the summer months.

Vegetation in the site vicinity is characteristic of the northern reach of the Sheep Creek Range; trees are absent, and the shrub community is an intricate mosaic of tall sage (*Artemisia tridentata*) and low sage (*A. arbuscula*). The on-site stand of tall sage is particularly dense and robust (crown cover was estimated at 60%), a reflection of the well-drained, relatively deep loams at the base of the canyons. Fingers and patches of low sage are interspersed among the tall sage on surrounding slopes. Native perennial bunchgrasses include Great Basin wildrye (*Elymus cinereus*), bluebunch wheatgrass (*Agropyron spicatum*), squirreltail (*Sitanion hystrix*), and Idaho fescue (*Festuca idahoensis*). Their current sparseness is the product of modern livestock grazing; we expect them to have been considerably more abundant in prehistoric times. In the spring of 1994, after a season of restricted access to cattle, wild rye was abundant in the area around the site. Phlox (*Leptodactylon* sp.), buckwheat (*Eriogonum* spp.), and lupine (*Lupinus* sp.) occur sporadically in favorable microhabitats. The thin rocky soils of the adjacent ridges appear to be good habitat for bitterroot (*Lewisia rediviva*), an ethnographically attested food species, although none was observed in the field.

Wildlife noted during fieldwork included burrowing rodents, cottontail rabbits (*Sylvilagus nuttallii*), coyotes (*Canis latrans*), hawks, songbirds, lizards, and ticks (*Dermacentor* sp?). Relict

TOSAWIHI QUARRIES:
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Note:

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burrows attest the recent presence of badgers (*Taxidea taxus*) and a family of four was observed along the Silver Cloud Road 1-2 km northeast of the site. Mule deer (*Odocoileus hemionus*) were not observed in the site vicinity in either the 1992 or 1994 spring excavations seasons, but archaeological field crews have observed them frequently over the past five years on the higher slopes and ridges 1-2 km to the east. Antelope (*Antilocapra americana*), frequent visitors to the broad, open valleys and tablelands lying a few km northeast, were occasionally observed visiting a cattle pond along the Silver Cloud Road 3-4 km southwest of the site.

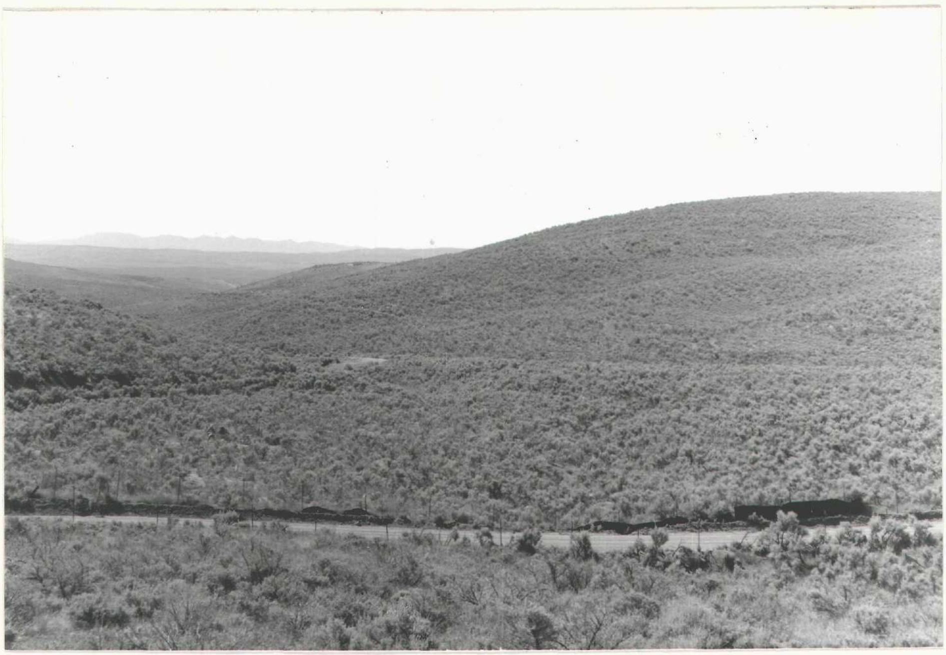

Figure 5. Overview of 26Ek5040, looking southwest.

Cultural Setting

A century and a half ago, virtually the entire Great Basin was inhabited by peoples speaking various languages of the Numic branch of the Uto-Aztecan linguistic family (Miller 1966). Among the largest of the Numic subgroups, the Western Shoshone occupied an enormous territory covering about half the present-day state of Nevada as well as smaller portions of Utah, California, and Idaho (Figure 6). Ethnographic accounts of Western Shoshone lifeways were compiled and synthesized during the present century, chiefly by J.H. Steward (1937, 1938, 1939, 1941, 1970); useful summaries of the work of Steward and other ethnographers have been compiled by Janetski (1981) and Thomas, Pendleton, and Cappannari (1986).

26Ek5040 lies in the northwestern extreme of Western Shoshone territory (cf. Figure 3), in a region ascribed by Steward (cf. esp. 1938) to the *Tosawihi* ('White Knives') Shoshone of the upper Humboldt River drainage. Harris (1940) reconstructed many details of aboriginal Tosawihi life in his study of subsequent acculturation of that group, and Raven (1992) recently summarized data gleaned from early travellers' reports and more formal ethnographic observations. The following sketch deals only with those aspects likely to be significant for understanding the archaeological record of 26Ek5040.

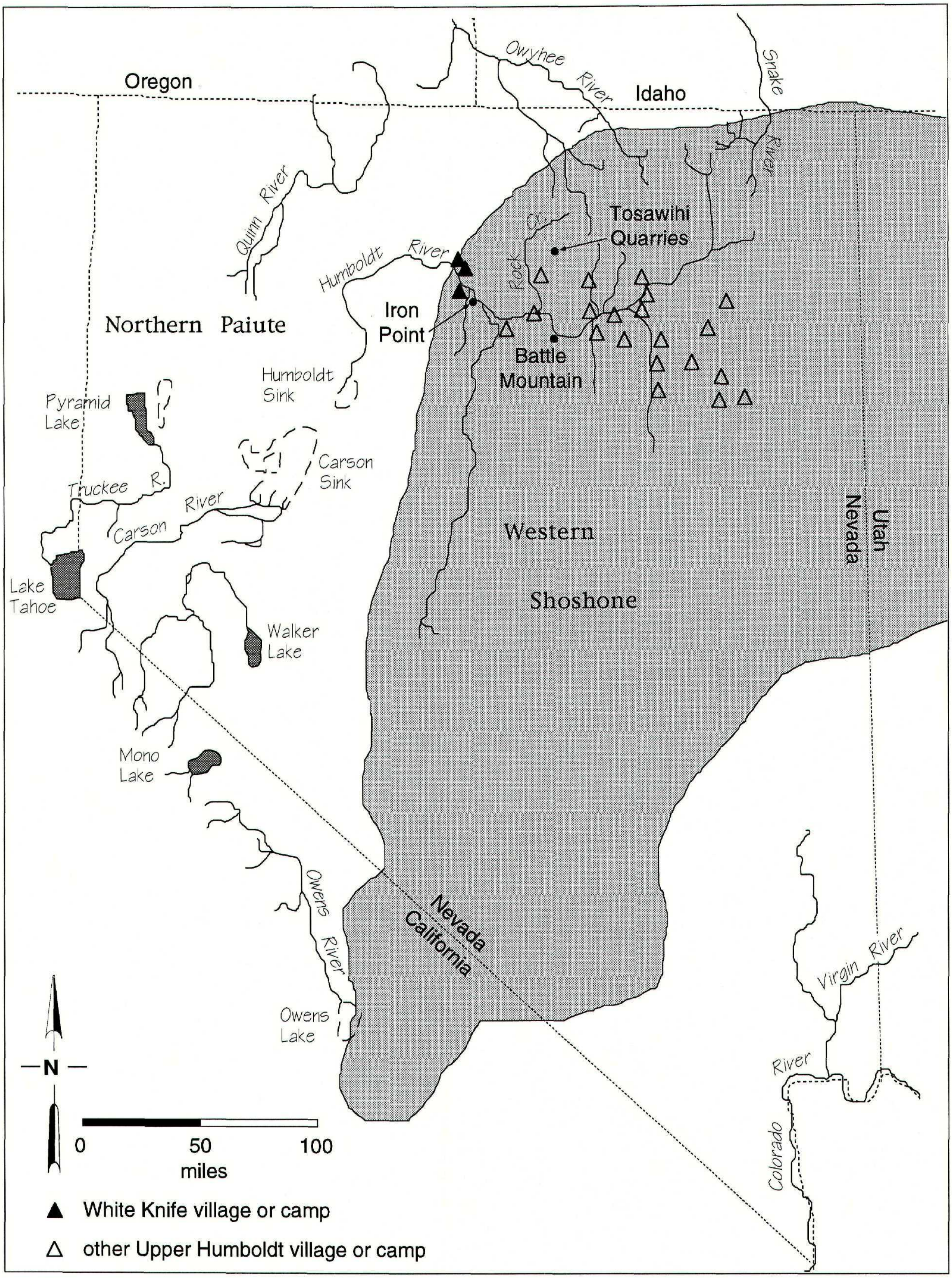

Figure 6. Western Shoshone Territory (after Steward 1937, 1938).

The Tosawihi wintered along the Humboldt River, by most accounts in small, multi-family camps in the vicinity of Battle Mountain. Most of the dry season was given over to dispersed foraging in higher country and considerable mobility over an extensive range—south toward Austin for pinyon nuts, north to the Snake River Plain for salmon, to Iron Point and back to Battle Mountain for festivals. The hills above Rock Creek were reported by Steward (1938:162) to be an especially favored foraging zone. Its attractions probably were enhanced by its proximity to vast fields of opalite toolstone, the exploitation of which the local group owed its name. 26Ek5040 lies within this favored area.

The Tosawihi shared a boundary with the Northern Paiute (Steward 1937, 1938), with whom by most accounts they interacted amiably. It is unlikely that a strict territorial boundary was observed or defended. Given the mobility of most northern Great Basin foraging peoples, in fact, it is probable that Northern Paiutes sometimes visited Rock Creek, the opalite quarries, and perhaps even 26Ek5040. Since the material culture of both Paiute and Shoshone was simple, limited to a relatively few technologically and stylistically equivalent categories of thing, there can be little hope of discriminating on the basis of the archaeological record which group was present at any particular time.

The prehistory of the region is known from a variety of sources, including research at Valmy to the southwest (Elston et al. 1981), at Rossi Mines to the southeast (Rusco et al. 1982), and along the southern reach of Rock Creek (Clay and Hemphill 1986). Long term, detailed investigations in the Tosawihi area, including surveys (Budy 1988; Elston, Raven, and Budy 1987; Raven 1988; Leach and Botkin 1992) and extensive excavations (Elston 1989; Elston and Raven 1992a, 1992b) have disclosed a 10,000 year history of human visitation, the later several millennia of which focused largely on the procurement of opalite as toolstone. The archaeological record suggests particular intensification of use over the past 1500 years. While the Tosawihi Quarries lie only 3 km east of the site (cf. Figure 3), 26Ek5040 falls well within the much larger *Tosawihi production sphere*, estimated at just under 800 km^2 (Leach and Botkin 1992), in which Tosawihi opalite continued to be processed and transported and, local geology permitting, quarried (though less intensively). A quarry pit complex, for example, occupies a ridgecrest only 1 km northwest of 26Ek5040 (cf. Figure 4).

A stratified, random sample survey of the Tosawihi vicinity (Leach and Botkin 1992) resulted in the archaeological inventory of 280 m x 280 m quadrats in the neighborhood of 26Ek5040. Of 23 quadrats surveyed within the 1800 ha surrounding the site (Figure 7), only two contain no prehistoric cultural materials. Most quadrats (n=21) contain at least sparse to moderate density lithic scatters reflecting a preponderance of middle to late stages of biface reduction; five also contain milling stones (usually only one specimen), two contain quarrying features, and one apparently is a residential site with a relatively diverse stone tool assemblage. A second residential site was recorded outside any survey quadrats, adjacent a spring.

Clearly, most parts of the local landscape were visited prehistorically, and although the bulk of the archaeological record (small reduction and tool maintenance stations) signals ephemeral, short-term use, considerable locational, functional, and material diversity is expressed in a small area. Most *kinds* of place (including ridge crests, knoll tops, slopes, terraces, and drainage margins) were used, numerous categories of activity (including temporary residence, quarrying, hunting, plant food procurement and processing, lithic production, and tool maintenance) were performed, and a variety of lithic materials (including Tosawihi opalite, jasper, and basalt, all probably of local origin, as well as imported obsidian) were employed.

Interestingly, time-marking artifacts noted so far in the 1800 ha surrounding the site consist only of Great Basin Stemmed, Gatecliff, and Elko projectile points, and a possible crescent (Leach and Botkin 1992), a pattern which, if it survives subsequent research, contrasts sharply with the temporal profile of the Tosawihi Quarries where Late Archaic time markers are more common (Elston 1989; Elston and Raven 1992a, 1992b).

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Research Goals in the Context of Previous Research

Research conducted so far in the Tosawihi vicinity has been guided by an evolving suite of problem domains, theoretical models, hypotheses, and empirical questions. The overall framework of inquiry has undergone considerable refinement and refocusing in light of the ongoing accumulation and analysis of data (cf. especially Elston 1988, 1989; Elston, Raven, and Budy 1987; Elston and Raven 1992a, 1992b; Leach and Botkin 1992), but central to all investigations has been concern with understanding the economics and strategies of toolstone procurement. Since the extraction of toolstone was the principal goal of prehistoric visits over several millennia, understanding the prehistory of the area demanded inquiry into how viable stone sources were discovered and evaluated, how raw toolstone was removed from the ground, how and to what extent it was processed in the field prior to transport, and how the products and by-products of extraction and production were manifest in the archaeological record. Additional critical questions involved the spatial structure of task segmentation, the organization of support measures (such as the procurement of food), and the seasonal and geographic integration of toolstone procurement into larger economic, technological, and social patterns.

Prior to testing, several attributes of 26Ek5040 suggested that the site might shed important light on various of these questions. While not constituting a locus of toolstone extraction itself, the site lies relatively near the main body of the Tosawihi Quarries (26Ek3032) as well as lesser, but closer, exploited sources of opalite. It is, however, sufficiently distant from these sources (2 km and 1 km, respectively; cf. Figure 3) that spatial considerations are likely to have come into play in the composition of the archaeological record. After toolstone was extracted at Tosawihi, a large proportion was made into bifaces. Biface manufacture can be divided into stages; at Tosawihi, different stages tend to be segregated in space. Early stages of reduction (through early Stage 3) were usually performed near stone sources, though often somewhat removed from the actual locus of quarrying; bifaces were exported from the greater Tosawihi vicinity, however, at mid-to-late Stage three, subsequent to heat-treatment (a process that improves the flaking quality of the stone; cf. Ataman, Carambelas, and Elston 1992; Bloomer, Ataman, and Ingbar 1992). This implies that the final stages of reduction, including heat-treatment, were performed farther from quarries, probably at camp sites located closer to subsistence resources (water and food). Reduction stages reflected in bifaces and debitage at 26Ek5040, therefore, should situate the site along that portion of the reduction continuum lying between extraction of raw material and final export of toolstone packages from Tosawihi, thereby further clarifying the role of distance in structuring the Tosawihi production sphere.

The chronology of human presence in the hills around the site is poorly understood at present; time-sensitive artifacts observed in survey contexts (Great Basin Stemmed, Gatecliff, Elko, and a possible 'crescent' of Tosawihi opalite) seem to reflect only the Pre-Archaic, Early, and Middle Archaic periods, although exploitation of the nearby Tosawihi Quarries underwent considerable intensification in the Late Archaic (Ataman et. al 1992). Since Late Archaic time markers have not yet been detected in the 1800 ha surrounding 26Ek5040 (Leach and Botkin 1992), the region, as well as the subject site, may inform on earlier land-use patterns in the Tosawihi hinterlands. If this is so, careful consideration of the opalite fraction of the artifact and debitage assemblage, as well as of its relation to the exploitation of other lithic materials, may help clarify strategic and economic changes in toolstone extraction, processing, and transport.

Results of Testing

Archaeological test excavations conducted at 26Ek5040 in 1992 produced data used to evaluate the eligibility of the site for inclusion in the National Register of Historic Places as well as to formulate the goals of the present research. Despite the absence of an on-site usable toolstone source, test data confirmed the site location as a component of the production zone of the Tosawihi Quarries (Leach and Botkin 1992); that is, the primary activities represented at the site are connected to the acquisition and processing, but not primarily the use, of locally available lithic raw material. As such, information available at this site, and that derived from previous work at Tosawihi, is inextricably linked. In addition, limited chronological data recovered from the site suggested that indeed the primary occupation of the site was probably centered on the Middle Archaic, thus providing opportunity for contrast with previous work. The depth of cultural deposits encountered in the test also allowed the possibility for *in situ* changes in technology and biface production strategies. Thus the test demonstrated that 26Ek5040 had the potential to confirm and extend analytical and theoretical observations used in planning and developing previous research (Elston 1988; Elston, Raven, and Budy 1987; Elston and Raven 1992a, 1992b) as well as to address new questions identified in the course of our work there (Ataman et al. 1992). The following chapters describe the data recovery phase of the project; test data are included as indicated.

Chapter 2

RESEARCH METHODS

Margaret Bullock

Data recovery methods employed at 26Ek5040 were designed to recover information relevant to site-specific research questions and to questions regarding the place of 26Ek5040 in the larger context of the Tosawihi Quarries (Ataman et al. 1992; Elston and Raven 1992b). Fieldwork included contour mapping, intensive surface reconnaissance and systematic collection, lithic feature inventory, excavation of all surface and subsurface features, and judgmental sampling of landforms for subsurface deposits with backhoe trenches, excavation units, and mechanical scraping.

Field and Laboratory Methods

We tested 26Ek5040 in the spring of 1992. Site boundaries encompass approximately 3.3 hectares; within this area 25 surface lithic features were identified and 125 surface artifacts were collected. During testing, a sample of eight features and two non-feature areas, stratified by landform, was chosen for excavation. Testing included surface reconnaissance and collection, and stratigraphic examination of drainage cuts and excavation units (Ataman et al. 1992).

Data recovery in 1994 began with systematic surface survey to relocate the features identified during testing and to evaluate previously identified site boundaries. As a consequence, the boundaries were altered slightly; seven additional surface features (Figure 8) and 279 more surface artifacts were found (Figure 9). Several methods of excavation explored cultural deposits (Table 1, Figure 10). All surface features which had not been excavated during testing were explored with blocks of 1 x 1 m surface scrapes to a depth of 4 centimeters. The number of scrapes in each block varied judgmentally by feature, according to feature size, composition, and content. Those units with potential for subsurface deposits were continued as excavation units (EU) in arbitrary 10 cm levels from an established datum, usually until culturally sterile deposits were encountered. Clearly delimited stratigraphy was difficult to see during excavation, but when encountered, samples from each stratum within arbitrary levels were delineated through the use of unique lot numbers. A total of 72 scrapes and 16 EUs (64 EU levels) were excavated in surface feature contexts (cf. Table 1). All soil and cultural material was screened through 1/4 in mesh; artifacts were collected and bagged by provenience, then returned to the laboratory for processing.

Table 1. Number of Units Excavated per Context in 1994.

	Scrapes	*EU levels	Mechanical Scrapes
Surface Feature	72	64	
Subsurface Feature	12		
Nonfeature Contexts	10	35	7
Total	82	111	7

*EU=Excavation unit

Ten additional surface scrapes, six of which were continued as EUs, were placed in non-feature areas (cf. Figure 10) to aid examination of the extent of subsurface cultural deposits. In order to

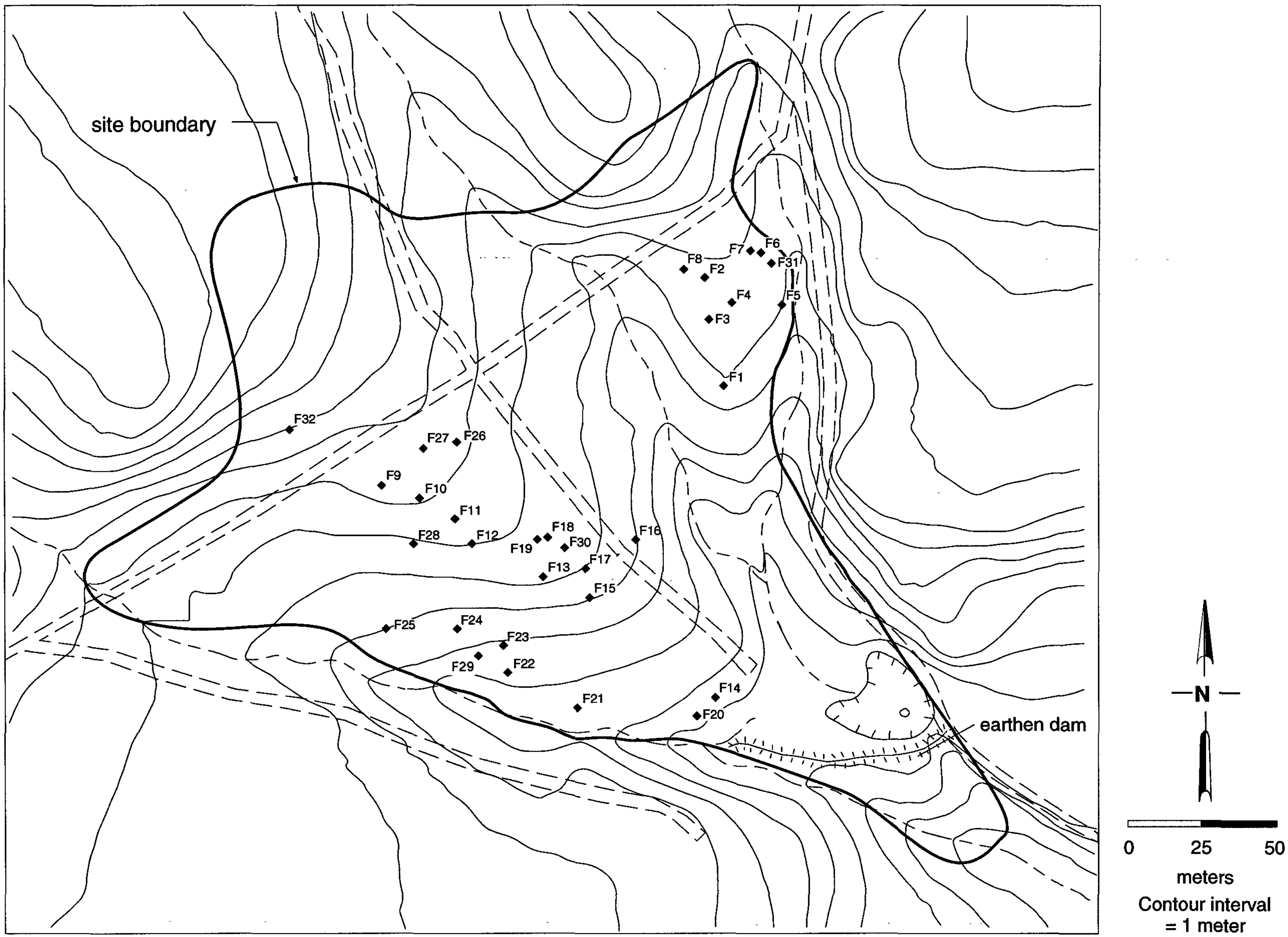

Figure 8. Distribution of features at 26Ek5040.

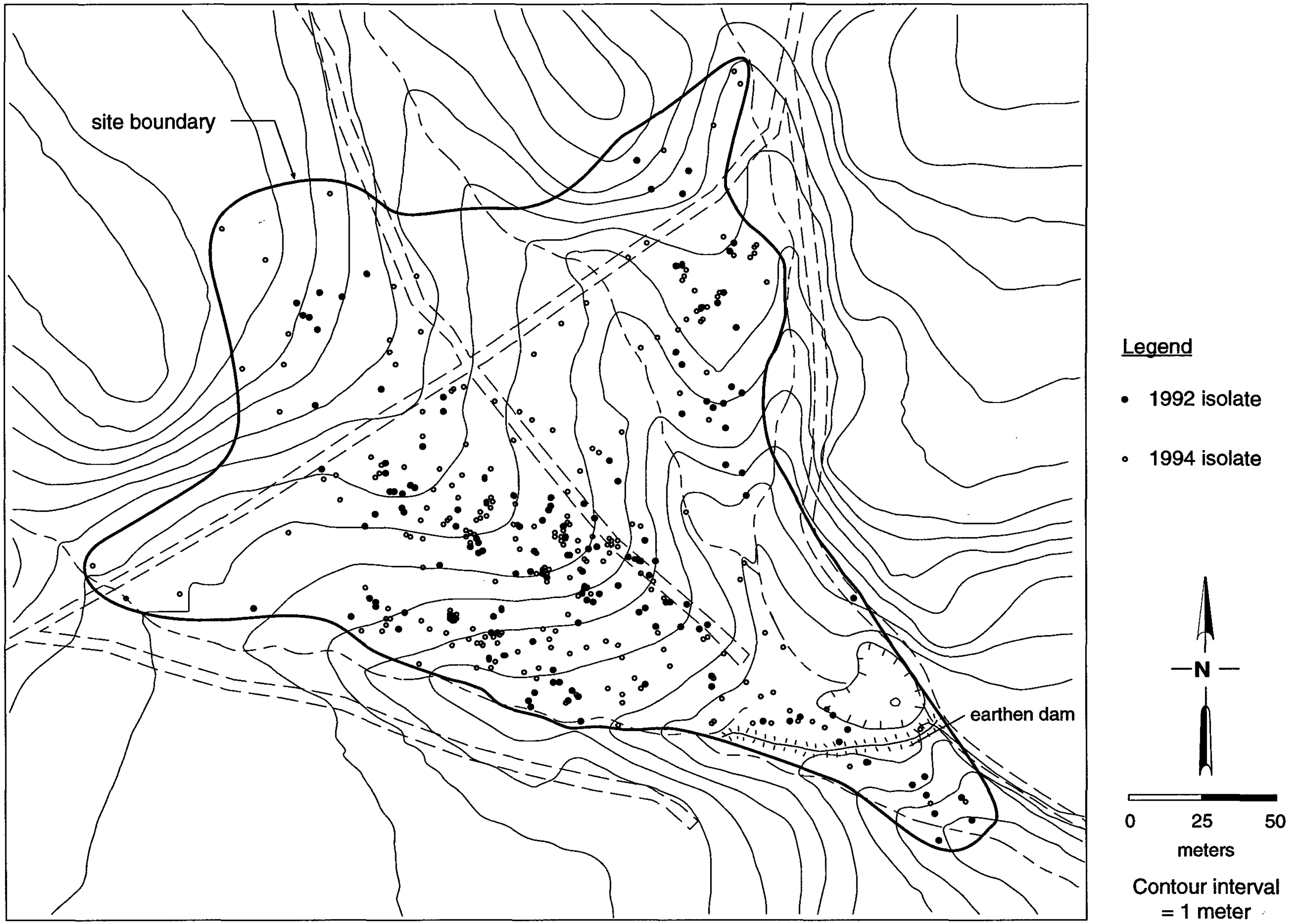

Figure 9. Distribution of surface isolates at 26Ek5040.

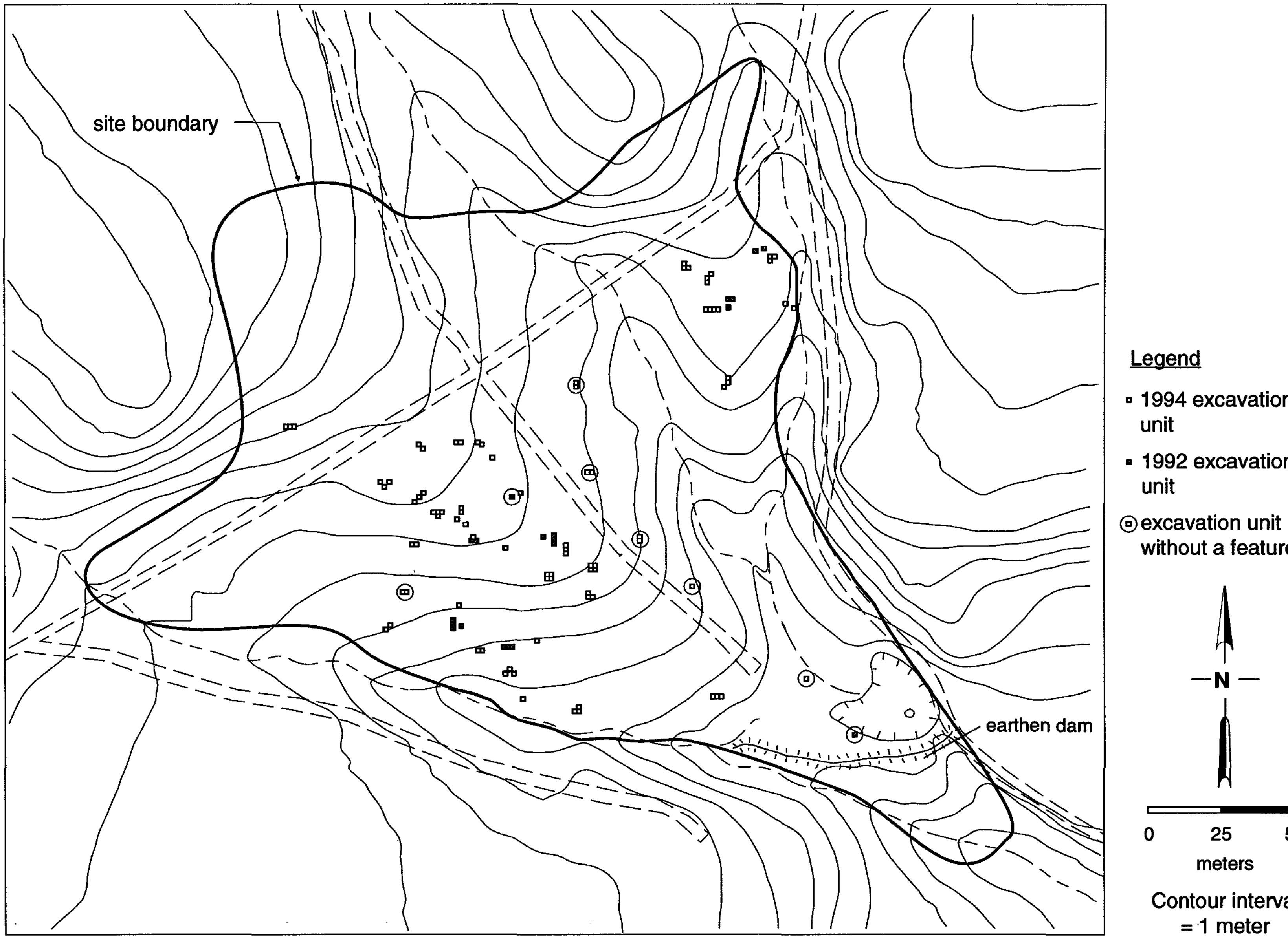

Figure 10. Location of excavation units at 26Ek5040.

facilitate comparison with returns from the surface feature units, each was begun as a 4 cm surface scrape (Level 1) then excavation proceeded from Level 2 in 10 cm arbitrary levels from a datum. Screening and artifact collection procedures were identical to those described above.

Other means used to explore site deposits included soil coring using a handheld soil probe with a 3.5 cm diameter barrel, backhoe trenching, and mechanical scraping (Figures 11, 12). Twenty soil cores and nine backhoe trenches (Figure 13) explored site depositional history; these were placed to test a variety of landforms. Cores, trenches, and excavation units were described and profiled by the project geoarchaeologist. Detailed discussion of his findings appears in Chapter 3.

Once all excavation was completed, seven areas of variable size (Figure 14) were mechanically scraped to a depth of approximately 10 cm below surface, a method that has proved useful for locating subsurface features such as hearths in previous excavations in the Tosawihi quarries (Schmitt et al. 1992:43). A number of roughly circular fire blackened areas at 26Ek5040 were revealed by this method, but most appeared to be recent sagebrush root burns. The six that looked most promising were bisected with an excavation unit and soil samples collected; descriptions of these features follow in Chapter 3. All excavations were backfilled to grade upon conclusion of the field phase of the project.

Once transported to the laboratory, collections were cleaned, sorted, labeled, and cataloged. Each distinctive artifact or lot of artifacts was assigned a catalog number comprised of site number, reference number, and specimen number. Numbers were applied directly to artifacts using indelible white or black ink covered with clear lacquer. Debitage samples were scanned to identify tools (which were given their own unique numbers) and then cataloged in lots. A computer catalog was created, which includes in addition to provenience, the class, type, material, count and weight of each item or sample.

Artifact Analysis

Certain standard analytical methods are applied consistently throughout the Great Basin to describe and classify particular kinds of artifacts. Our analysis follows procedures developed by Thomas (1981) for projectile points and by Ataman (1992a) for flake tools. Measured attributes of projectile points appear in Appendix F. Groundstone analysis follows Mikkelsen (1989, 1993) and Adams (1989) as modified by Bullock (1994a); hammerstone analysis follows previous Tosawihi usage (Schmitt 1992a).

Biface manufacturing stages used here are those outlined by Callahan (1979) as modified in our previous analyses at Tosawihi (Bloomer, Ataman and Ingbar 1992; Ataman 1992b). In this descriptive system, Stage 1 represents a selected blank before it has been reduced and Stage 2 the edge prepared blank. By Stage 3 primary thinning has been accomplished, while secondary thinning is used to indicate Stage 4. We have used Stage 5 to represent a biface on which finishing has been initiated, that is, basal shaping, edge straightening, or pressure flaking detail. Stages 2, 3, 4, and 5 are further subdivided; Stages 2, 4, and 5 are divided into early and late, and Stage 3 into early, middle, and late. Because Tosawihi opalite is variously colored and because some colors are particular to specific quarry localities, the colors of bifaces were also recorded.

Debitage Analysis

Prior to size grading, each sample of opalite or local chert debitage was evaluated for presence of heat-treatment (expressed as a percentage) and proportion (by weight) of white opalite to other colors. Each debitage sample then was size graded through nested screens of 2 in., 1 in., 1/2 in., 1/4 in., and 1/8

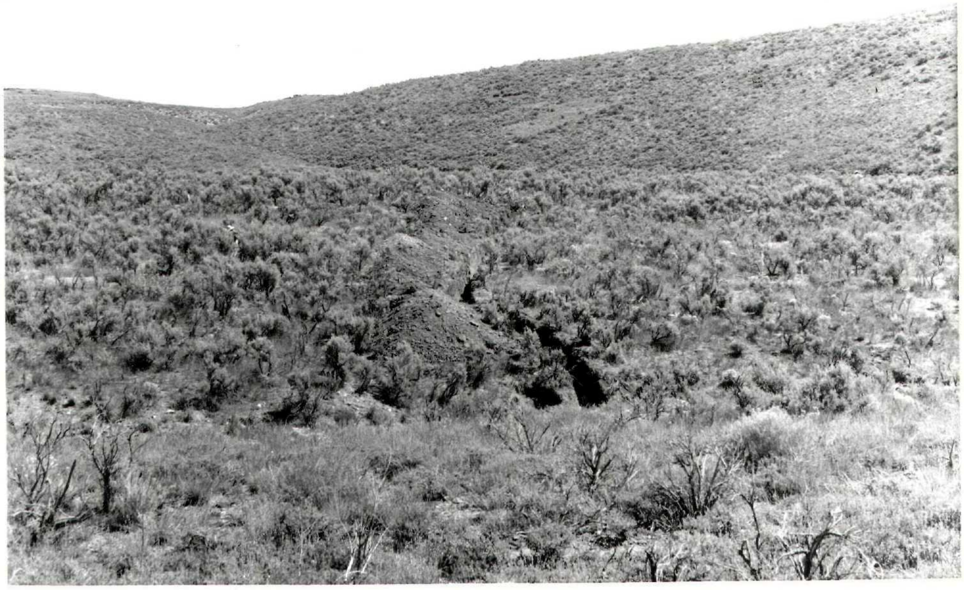

Figure 11. A view of Trench F from the west.

Figure 12. Use of backhoe for surface scraping.

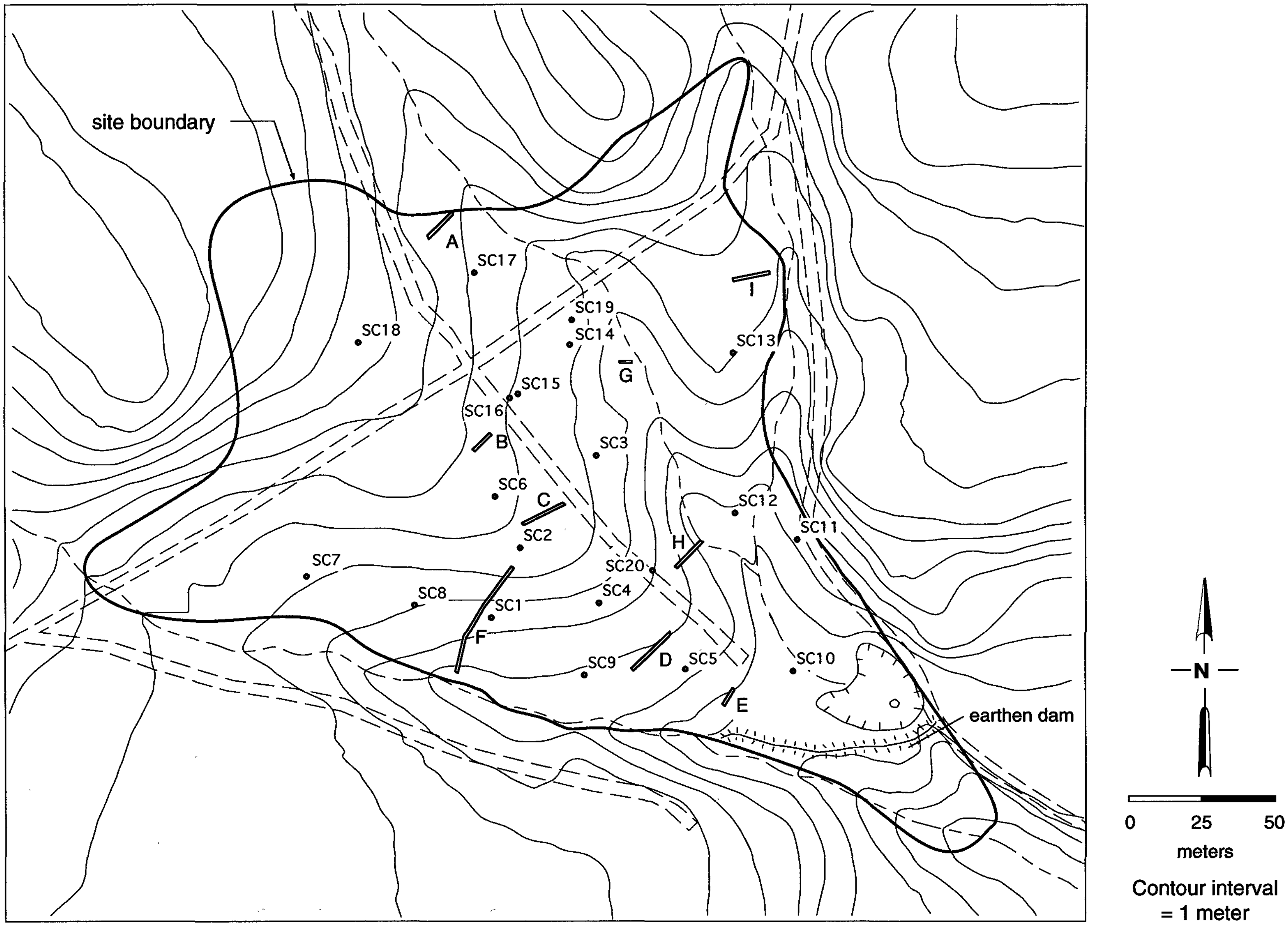

Figure 13. Location of soil cores and backhoe trenches at 26Ek5040.

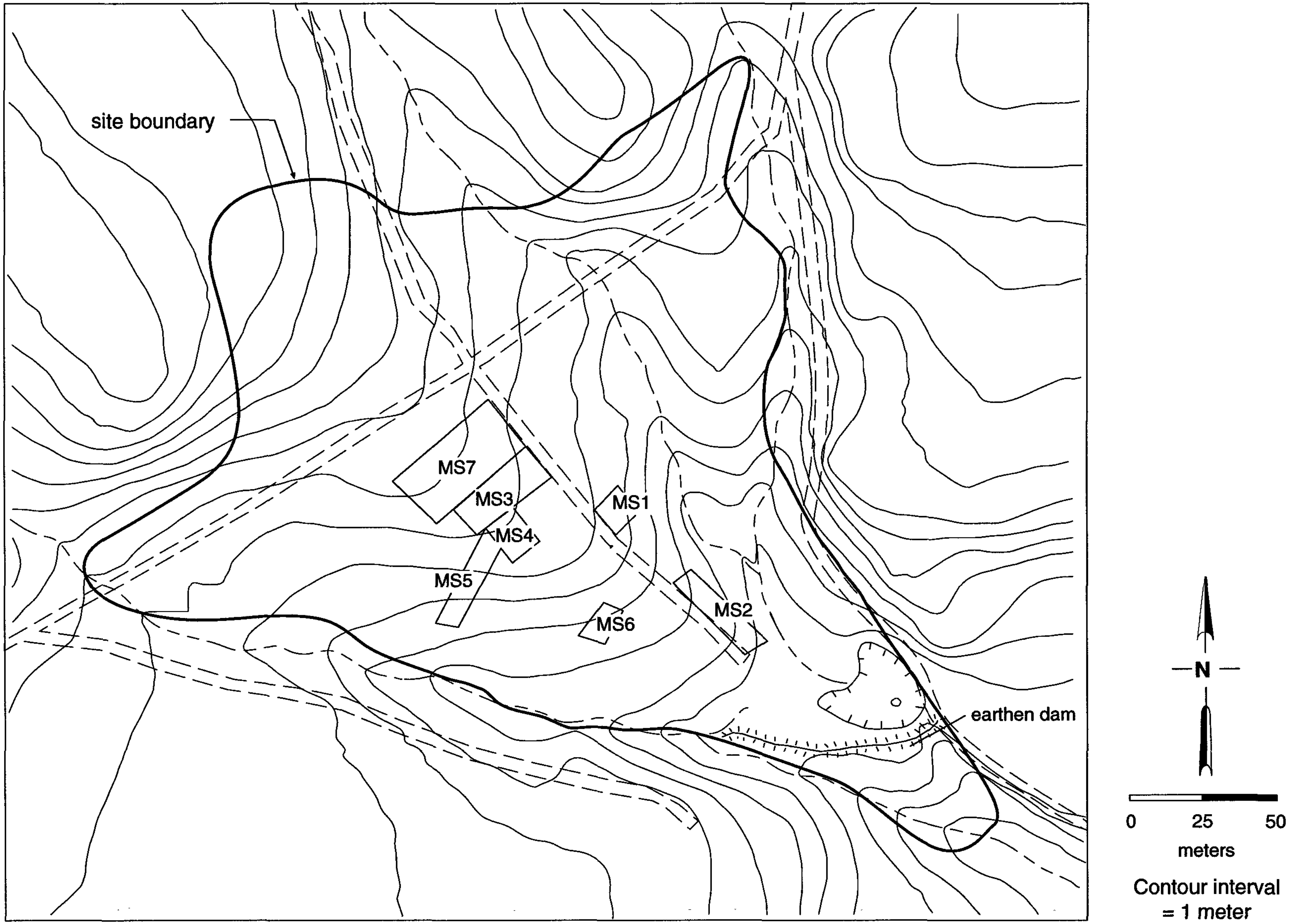

Figure 14. Location of mechanical scrapes at 26Ek5040.

in. mesh, with the portion collected in each screen bagged and weighed separately. These procedures are intended to identify variation in debitage density, composition, lithic source, and degree of heat treatment both horizontally and vertically across the site. Opalitic and basaltic cherts were treated differently during cataloging. Although combined by level in the color and heat treatment analyses, these were considered as separate samples in the debitage analysis.

Once size grading was completed, debitage samples were scanned for technological characterization. Previous work at Tosawihi has shown that the range of technological variation present in recovered debitage samples is limited, with the primary focus on biface production. Evidence for some projectile point manufacture often is recovered from non-quarry sites and, in addition, evidence of flake core technology (primarily confined to basalt and obsidian collections) is also present. Therefore, the descriptions that follow of changes in heat-treatment, color, or technology are for biface debitage; other technologies are described as encountered.

The technological characterization used herein follows that described by Ingbar, Ataman, and Moore (1992:51-59). In this scheme, samples are examined and characterized as a lot rather than as individual flakes. Testing has shown that several types of reduction previously noted at Tosawihi, particularly early stages seen most frequently at true quarry sites, are not represented strongly at 26Ek5040, i.e., quarrying, mass reduction, and blank preparation/initial edging (Ataman et al. 1992). In the present study, therefore, the scheme was simplified and only core reduction, edge or blank preparation, early and late stages of biface thinning, pressure flaking (or retouching), or indeterminate reduction (when the sample was too small to characterize accurately) were noted. Any given sample can be characterized by five categories of debitage: core reduction (C), edge or blank preparation (B), early thinning (E), late thinning (L), or retouching (R). If one of these categories is represented by only small amounts of debitage, a lowercase letter denotes that fact. If a category is represented abundantly but does not dominate the sample, a capital letter is used; a dominant category is denoted by an underscored capital letter. There are, then, four possible attribute states for any given category: blank (category is not represented in the sample), lowercase, uppercase, or emphasized uppercase; these can be combined as appropriate to characterize a sample.

A large quantity of small debitage was noted during excavation of Unit Q8, Levels 4 and 5 (Feature 11). Two samples (Q8-4-2.1, Q8-5-2.1) of this flake concentration were collected and analyzed since concentrations of this sort may signal a heat-treatment hearth or in-situ reduction locale. Samples were washed through a series of nested screens (4 mm, 2 mm, 1 mm, 500 microns) and each fraction was analyzed for the types of flakes present. Results are reported in Chapter 3.

Other Analyses

Obsidian, charcoal, tephra, and botanical samples were sent to specialists for analysis. Obsidian hydration rind measurements were collected by Thomas Origer of the Sonoma State University Academic Foundation, Inc., and x-ray fluorescence sourcing analysis was conducted by Richard Hughes at Geochemical Research Laboratory. A total of forty-nine obsidian artifacts (10 tools, 39 pieces of debitage) were analyzed. Reports of results from both analyses are appended (A and B) hereto.

Charcoal samples from two hearth features were sent to Beta Analytic for radiocarbon dating (see Appendix C). Sample 26Ek5040-AM1-3-6.1 returned a date of 850±200 B.P. (Beta-74722); the second sample (26Ek5040-Q5-2-3.4) contained insufficient carbon for dating and was not processed. In addition to these samples from feature contexts, a soil sample was submitted for dating of the organic fraction. This sample (Beta-71239) returned a date of 4380±90 B.P.

A sample of what appeared to be volcanic ash from Trench F was sent to Franklin Foit, Jr. of Washington State University for identification (see Appendix D). Results are discussed in Chapter 3.

The residue from the flotation of ten soil samples from six units was sent to Nancy Stenholm of Botana Lab for botanical analysis. The flotation method used employed a screen-bottom (1.4 mm mesh), three-gallon bucket and a low pressure water spray. The light fraction of each sample (the materials which rose to the surface of the bucket) was decanted into cheesecloth. The material remaining in the 1.4 mm screen in the bottom of the bucket constituted the heavy fraction. Samples were air dried and then sent on to Botana Lab. Results are reported in Appendix G.

Curation

Artifacts were bagged by artifact class, then by reference and specimen numbers in .002 or .004 mil plastic bags. Each ziplock bag contains a paper provenience tag and an artifact lot. The bags are packed in one cubic foot cardboard boxes. Each box is labeled with project number, box number, site number, and a brief list of contents. These are to be curated at the Nevada State Museum, Carson City, where previous Tosawihi collections are stored. Copies of the catalog, of field notes and photos, of projectile point keying forms and other analytical data, and of the final report accompany the artifacts.

Chapter 3

SITE STRUCTURE

Margaret Bullock, Daniel P. Dugas, Robert G. Elston, and Kathryn Ataman

This chapter describes the physical structure of 26Ek5040, how artifacts are distributed within that structure, and how structural information can be used to make inferences about human activity in this place.

Physical Setting

26Ek5040 is situated on a group of alluvial terraces cut by three small, confluent, ephemeral stream channels (cf. Figure 5). The terraces lie in a roughly triangular-shaped area below low hills of andesite and rhyolitic tuff bedrock mantled by colluvium. The ephemeral drainages have isolated northern and southern interfluves (low ridges) within the site. In general, at the northwestern end of the site, the ridges have fairly low relief with rounded crests between moderately incised drainage channels. At the southeastern end of the site, the drainages are cutting progressively headward and the interfluves appear more dissected. Three terrace surfaces occur on the interfluve landforms (Figure 15); much smaller, intermittent terraces also appear within the ephemeral channels but are too localized to correlate or map. Areal delineation of the three main terrace surfaces is based on their morphology and topographic position relative to the modern drainage.

Most of the site area is comprised of the Terrace 1 surface (cf. Figure 15). Located just above the modern drainage channels, Terrace 1 girdles the southern ridge from the southwest end, around the southeastern tip, and back to the northwestern flank. A lobe of Terrace 1 is also present on the northern ridge at its southeastern tip. Terrace 2 occupies the intermediate topographic position on the ridges; girdling the southwestern and northeastern flanks of the southern ridge, and comprising much of the northern ridge surface area. The Terrace 3 surface occurs along the ridge crests and is best demarcated by exposed or near-surface bedrock that apparently underwent pre-Holocene fluvial erosion prior to burial. The sediments and soils which underlie the three terrace surfaces are described below.

Stratigraphic Sequence

Several backhoe trenches (cf. Appendix H, Figures H.11 and H.13) , soil cores (cf. Figure 13, Appendix I), excavation unit exposures (cf. Figure 10), and a large "gully section" exposure below the earthen dam (Figure 16) disclosed important stratigraphic relationships. Correlation between these exposures revealed at least 26 stratigraphic units, representing sediments (coarse and fine grained alluvium, eolian silts, volcanic ash), the horizons of five paleosols, and the modern soil (Figure 17, Table 2). The most comprehensive and illustrative exposure of typical site stratigraphy was seen in Trench F (Figure 18).

Before proceeding with the site stratigraphy description, it should be noted that as excavation proceeded and strata were exposed, a stratum number was assigned to each depositional layer (parent material) and soil horizon as it was recognized and described. Stratum number assignments, however, are not strictly sequential, due either to the addition of some stratum numbers at later stages of the field endeavor or because soil horizon development may occur within sediments at some time after they are initially deposited (yet they occupy coincident positions in the stratigraphic profile). Therefore,

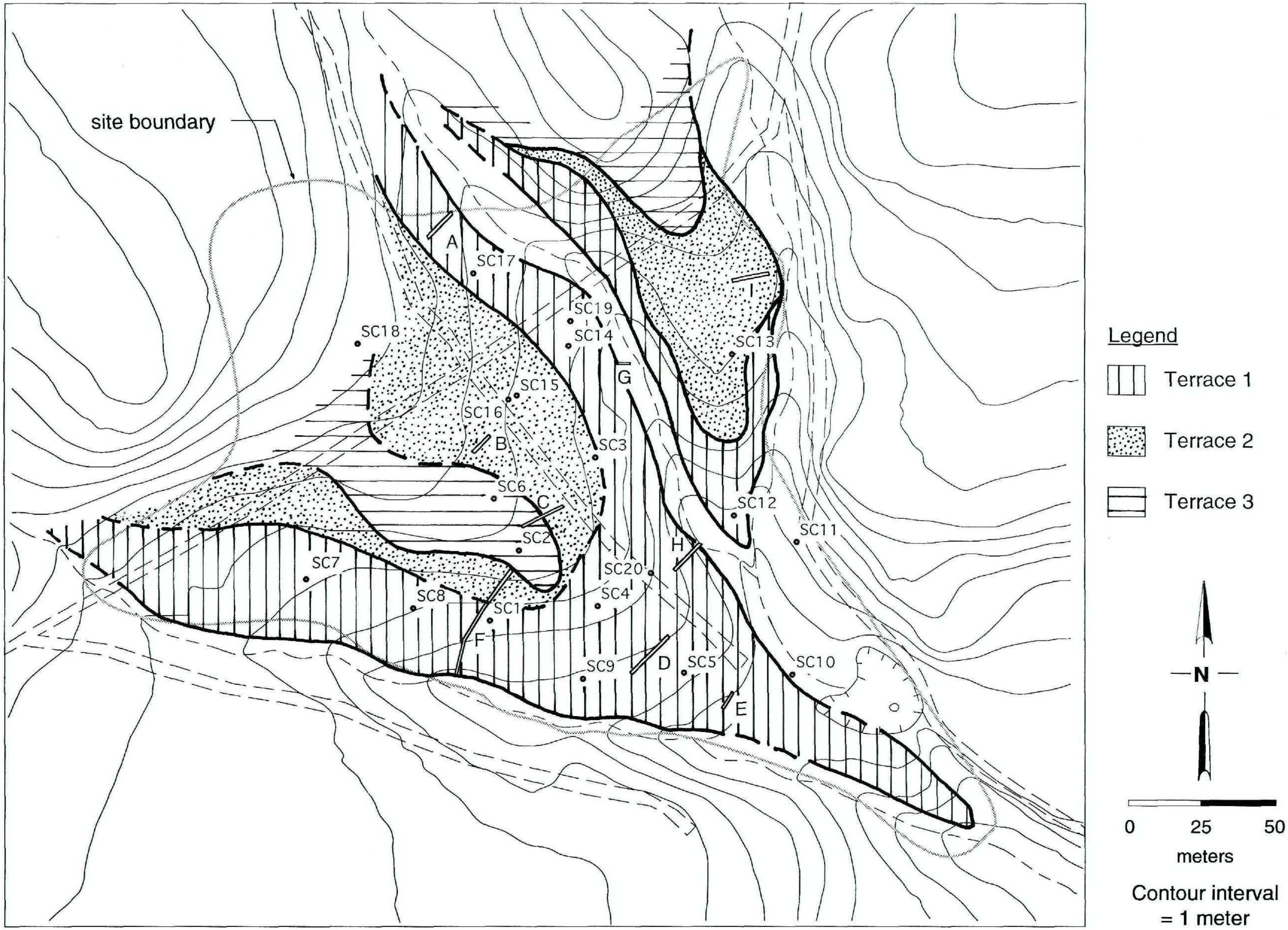

Figure 15. Site map of 26Ek5040 showing terrace surfaces.

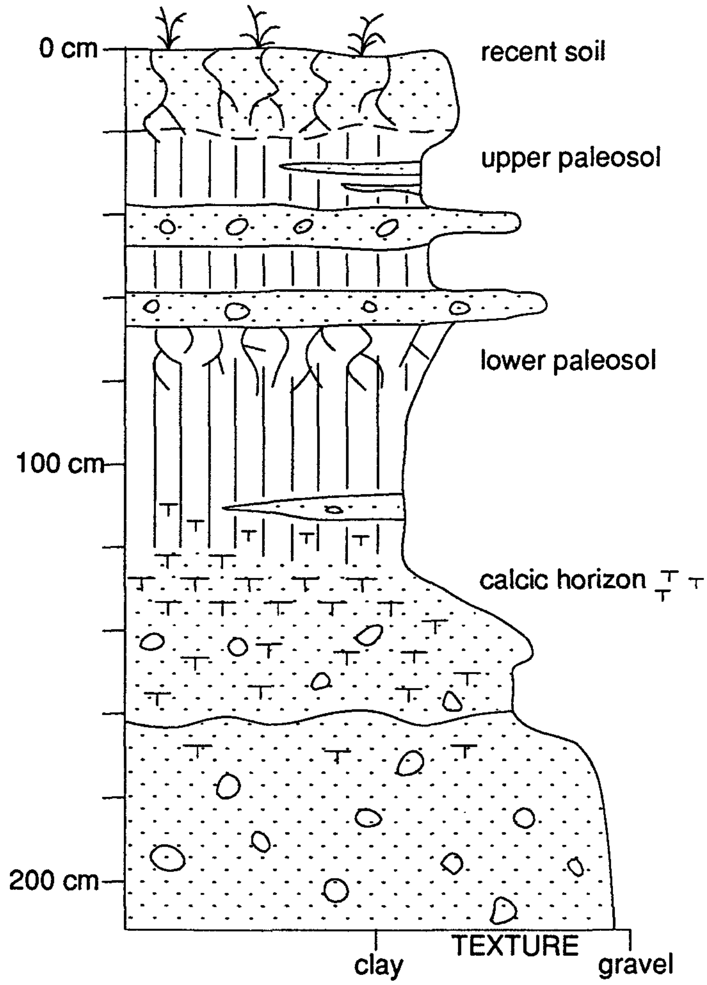

Figure 16. Stratigraphic profile of gully section.

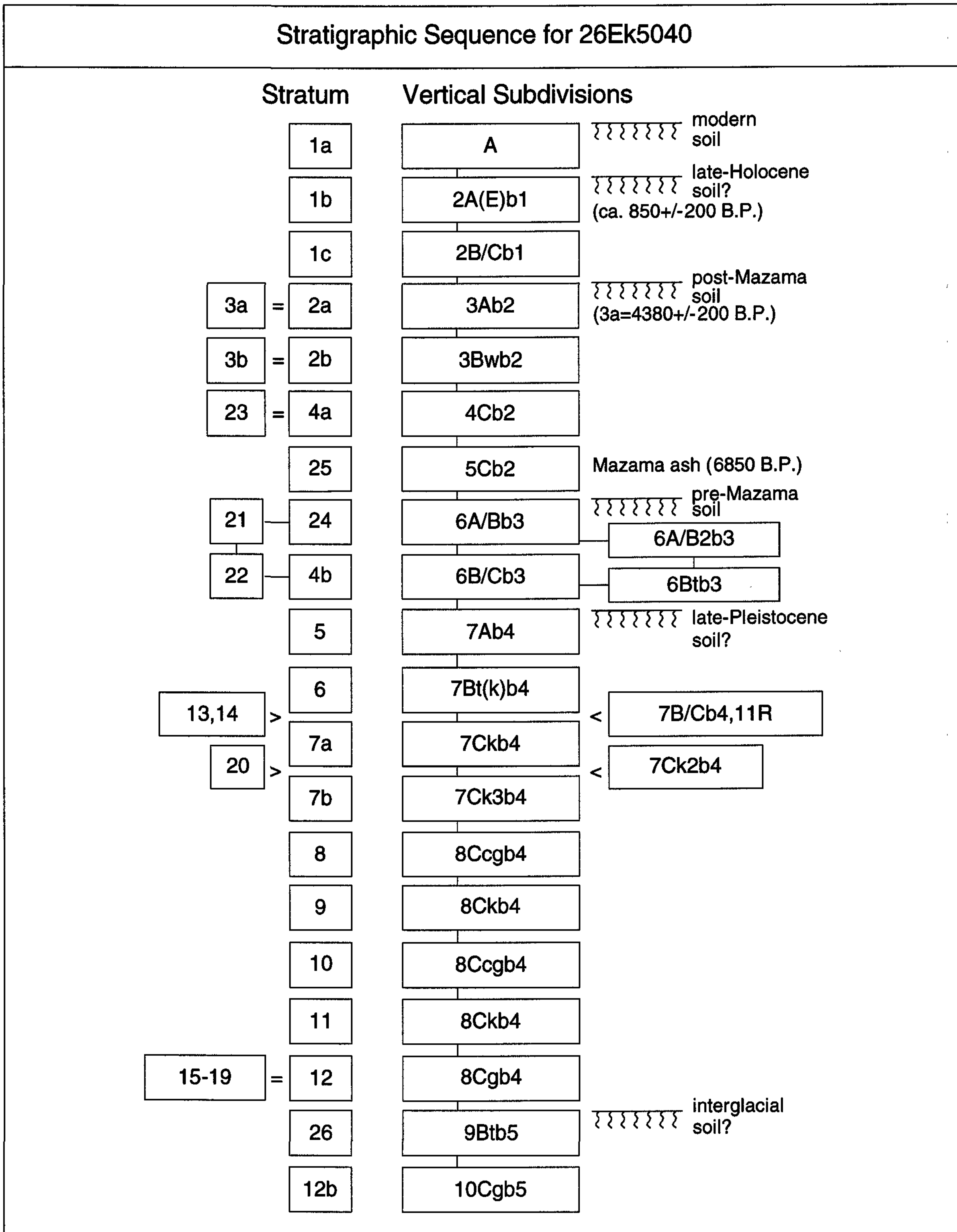

Figure 17. Stratigraphic sequence showing strata and equivalent vertical subdivisions.

using stratum numbers for both sedimentary units and soil horizons may not represent a true *temporal* sequence of stratigraphic events in the profile. Because of this lack of temporal clarity, a stratigraphic numbering system separate from the stratum numbers assigned during excavation is also presented here, using vertical subdivision designators (Soil Survey Staff 1975, 1990) (Figure 17 and Table 2). Vertical subdivision designators allow for separate depositional sedimentary layers and soil horizons to be described simultaneously while still allowing them to be indicated as distinct stratigraphic phenomena in the same descriptive system. A concordant, master soil stratigraphic sequence that reconciles the sedimentary sequence with the soil sequence is given in Figure 17 and Table 2 using vertical subdivision designators. Proceeding from left to right at each vertical subdivision, the first number (e.g., 1a, 1b, 2a, etc.) refers to each parent material consecutively encountered from the surface downward; capitalized letters refer to standard master soil horizons (A, typically organic-rich, surficial soil horizons; B, pedogenically-altered subsurface soil horizons; and C, non-pedogenic subsurface horizons). A master designation with a virgule, such as A/C, refers to a horizon with characteristics of both A and C. The master horizon E refers to a zone slightly leached of silicate clay, iron, and aluminum. Lower case letters which follow master horizon letters refer to subordinate horizon distinctions, such as c for accumulation of concretions (in this case manganese), g for gleying (a reduction of iron by water saturation), k for accumulation of carbonates, t for accumulation of silicate clay, and w for development of color or structure in a B horizon, but with no illuvial accumulation of materials. Where numbers follow either master or subordinate horizon letters, these refer to additional divisions of the horizon due to evident changes in structure, color, or texture that otherwise would not qualify them to be separated by some other element of the vertical subdivision name. Finally, the b at the end of the subdivision name designates portions of buried soils within the stratigraphic sequence. The b is followed by a number that refers to which consecutive buried soil the stratum is part of in a sequence from the surface downward.

Table 2. Descriptions of Stratigraphic Units at 26Ek5040.

Stratum No.	**Soil Horizon**	**Description**
1a	**A**	Very dark grayish brown (10YR 3/2 moist), dark grayish brown (10YR 4/2 dry); moderately-sorted very fine silt loam; moderate fine subangular platy to granular; slightly hard; friable, slightly sticky, nonplastic; noneffervescent; many fine roots, few very fine simple pores; boundary gradual and smooth. Modern soil surface of eolian silt with slopewash sediments.
1b	**2A(E)b1**	Similar to Stratum 1a except for slightly higher color value (5/2 dry) and firmer consistence. Stratum 1b appears to be a separate depositional unit from 1a and part of a former soil surface.
1c	**2B/Cb1**	Dark reddish brown (5YR 3/2 dry), sandy alluvial gravel unit lying directly above Stratum 2. Exposed only in `gully section'.
2a	**3Ab2**	Dark brown (7.5YR 3/4 moist), brown (10YR 5/3 dry); moderately-sorted very fine silty clay loam; very weak fine angular blocky; slightly hard to hard, very friable, slightly sticky, slightly plastic; noneffervescent; few to common thin argillan films; common fine to medium roots, common fine to medium simple open and closed pores; boundary clear and smooth. Parent material of eolian silt and slopewash sediments. Part of modern B horizon and possibly part of a buried A horizon.
2b	**3Bwb2**	Dark brown (7.5YR 3/4 moist), brown (10YR 5/3 dry); moderately-sorted very fine silty clay loam; moderate fine to medium angular to subangular blocky; slightly hard to hard, very friable, slightly sticky, slightly plastic; noneffervescent; few to common thin argillan films; common fine to medium roots, common fine to medium simple open and closed pores; boundary clear and smooth. Parent material of eolian silt and slopewash sediments. Part of modern B horizon and possibly part of a buried B horizon. May be equivalent to Stratum 23 in some portions of site.
3a	**3Ab2**	Dark reddish brown to yellowish brown (5YR 3/4 to 10YR 4/6 moist), brown (7.5YR 5/4 dry); poorly-sorted sandy clay loam; moderate fine to medium subangular blocky to prismatic; hard to very hard, firm, sticky, plastic; noneffervescent; few to common thin argillan films; very few fine roots, common fine simple open pores; boundary clear and wavy. Alluvium parent material. `Upper paleosol' of `gully section'. Dated by soil carbon average mean residence time to 4380 ± 90 B.P. (Beta-71239). Probable equivalent of Stratum 2 in other areas of site.
3b	**3Bwb2**	Similar to Stratum 3a. Transitional to Stratum 4a.

Table 2, continued.

Stratum No. / Soil Horizon	Description
4a **4Cb2**	Reddish brown (5YR 4/4 moist), yellowish red (5YR 4/6 dry); poorly-sorted gravelly very coarse to fine sandy clay loam; weak fine subangular blocky to structureless; hard, friable, slightly sticky, slightly plastic; noneffervescent; few fine roots, few fine simple closed pores; boundary clear and irregular. Parent material of soil clasts and gravel slopewash sediments. Transitional soil horizon above Stratum 25 ash, typically containing gravel and reworked soil clasts. May be equivalent to Stratum 23 in some parts of site
4b **6B/C2b3**	Dark brown (10YR 3/3 moist), dark reddish gray (5YR 4/2 dry), with pinkish gray (7.5YR 7/2 moist) spotty mottling; moderately-sorted coarse to fine sandy clay loam with angular gravel; strong fine subrounded granular (durinodes?); very hard, friable, sticky, plastic; noneffervescent; thin to moderately thick skeltan and silan films; very few fine roots, very few very fine simple pores; boundary clear and smooth to wavy. Parent material of alluvial and slopewash sands and silts with abundant clay. In Trench F: underlies Stratum 21 then merges with 21/22 to the northeast. Possible buried mollic surface horizon of the Strata 5/6 soil, or durinodes from an extremely eroded soil?
5 **7Ab4**	Black (5YR 2.5/1 moist), black to dark reddish brown (5YR 2.5/1 to 3/3 dry); slightly gravelly well-sorted very fine silty clay; strong fine angular blocky to prismatic; very hard, very firm, sticky, plastic; noneffervescent; common moderately thick argillan films and bridges; very few very fine roots; very few very fine simple pores; boundary abrupt and smooth. Organic-rich (?) upper portion of `lower paleosol' of `gully section'. Grades into Stratum 6; Stratum 5 to 6 contact is difficult to detect in most soil cores.
6 **7Bt(k)b4**	Yellowish red (5YR 4/6 moist) to strong brown (7.5YR 4/6 moist) to dark yellowish brown (10YR 3/4 moist)(colors varying according to degree of oxidation relative to local groundwater levels), dry colors only slightly higher in values, with yellowish red (5YR 4/6 moist) to strong brown (7.5YR 4/6 moist) mottling; slightly gravelly well-sorted very fine silty clay; strong medium angular to subangular prismatic; very hard, very firm, sticky, plastic; slightly effervescent (stage I) to locally very strongly effervescent (stage III); common moderately thick argillan and calcan films and bridges; very few very fine roots, very few very fine simple closed pores; boundary clear and smooth. Subsoil of `lower paleosol' in `gully section'.
7 **7Ckb4**	Yellowish red (5YR 4/6 moist), reddish brown (5YR 4/4 dry) with very pale brown (10YR 7/4 moist) carbonate mottles and stringers; clay loam with rare to common moderately-sorted medium to fine gravel; weak medium angular blocky; very hard, very firm, slightly sticky, slightly plastic; slightly to strongly effervescent (stage I to II); few thin argillan films, common moderately thick calcan films and pore fillings; no roots; very few fine simple closed pores; boundary abrupt to gradual and smooth. Parent material of fine alluvium with gravel lenses. C horizon of `lower paleosol'. 7b is similar to Stratum 7a except for a slightly higher color values.
8 **8Ccgb4**	Black (5YR 2.5/1 moist), dark reddish brown (5YR 2.5/2 dry); moderately-sorted, sandy loam; weak very fine angular blocky; hard, friable, nonsticky, nonplastic; noneffervescent; many moderately thick mangan films, pore fillings and brings; very few very fine roots, very few very fine simple open pores; boundary abrupt and smooth. This stratum is a series of manganese staining layers. It is probably a water table fluctuation feature and post-dates other soil formation features.
9 **8Ckb4**	Dark brown (7.5YR 4/4 moist), brown to light brown (7.5YR 4/5 to 6/4 dry), with very pale brown (10YR 7/3 moist) mottling of carbonate stringers and patches; gravelly moderately well-sorted medium to fine sandy clay loam; weak fine angular blocky/prismatic to massive; hard, firm, sticky, slightly plastic; very strongly effervescent (stage IV); many moderately thick calcan films, pore fillings and bridges, some possible thin argillans and silans; very few very fine roots, common fine simple open and closed pores; boundary clear and smooth to wavy. Parent material of moderately well-sorted medium to fine alluvial sand. Carbonate-rich Ck horizon of `lower paleosol' in `gully section'.
10 **8Ccgb4**	Same as Stratum 8. Includes 10a, b, and c.
11 **8Ckb4**	Same as Stratum 9.
12a **8Cgb4**	Dark brown (7.5YR 4/4 moist), brown to light brown (7.5YR 5/4 to 6/4 dry); gravelly moderately-sorted medium to fine sandy clay loam; weak fine angular blocky/prismatic to massive; hard, friable, sticky, slightly plastic; slightly effervescent; very few thin calcan films and pore fillings very few very fine roots, common fine simple open pores; boundary abrupt and smooth. Parent material of sandy gravel alluvium. Gravel-rich C/R horizon of `gully section'. Stratum 12b is similar to Stratum 12 but is separated from it by Stratum 26 and designated 10Cgb5.
13 **7B/Cb4**	Reddish brown (5YR 4/4 moist), yellowish red (5YR 4/6 dry); silty clay with abundant angular bedrock clasts; weathered bedrock float zone of Stratum 5/6 and Stratum 1/2 materials mixed with bedrock clasts.
14 **11R**	White to yellow (10YR 8/2 to 7/6 dry); rhyolitic tuff bedrock with cherty fine-bedding alternating with chalky to welded ash-fall beds.
15 **8Cgb4**	Dark brown (7.5YR 4/4 moist), brown to light brown (7.5YR 4/5 to 6/4 dry), with very pale brown (10YR 7/3 moist) mottling of carbonate stringers and patches; gravelly moderately well-sorted medium to fine sandy clay loam; weak fine angular blocky/prismatic to massive; hard, firm, sticky, slightly plastic; slightly effervescent; few thin calcan films and pore fillings, some possible thin argillans; very few very fine roots, common fine simple open and closed pores; boundary clear and smooth to wavy. Parent material of moderately well-sorted medium to fine alluvial sand. Equivalent to Stratum 12.

Table 2, continued.

Stratum No.	Soil Horizon	Description
16	**8Cgb4**	Similar to Stratum 15 except for more gravelly. Equivalent to Stratum 12.
17	**8Cgb4**	Same as Stratum 15. Equivalent to Stratum 12.
18	**8Cgb4**	Similar to Stratum 15 except for more gravelly. Equivalent to Stratum 12.
19	**8Cgb4**	Same as Stratum 15. Equivalent to Stratum 12.
20	**7Ck2b4**	Dark reddish brown (5YR 3/4 moist), yellowish red (5YR 4/6 dry); poorly-sorted gravel to fine sand; structureless; slightly hard, very friable, nonsticky, nonplastic; noneffervescent; no roots or pores; clear and smooth boundary. Parent material of poorly-sorted, subrounded to subangular gravel (<3 cm) and very coarse to fine sand alluvium with some silt matrix. Gravels of tuff and andesitic basalt lithology. Gravel lens within Stratum 6/7 of Trench F.
21	**6A/B2b3**	Very dark brown (10YR 2/2 moist), dark reddish brown (5YR 3/4 dry); silty clay loam with rare to common moderately-sorted medium to fine gravel; moderate to strong fine subangular prismatic; very hard, very firm, sticky, plastic; noneffervescent; few thin argillan and skeltan films and pore fillings; few fine roots, common fine simple open pores; boundary gradual and smooth. Parent material probably of fine alluvium and eolian silts. Pre-Mazama soil with slightly darker upper portion (Stratum 21). Found only in Trench F.
22	**6Btb3**	Very dark brown (10YR 2/2 moist), dark reddish brown (5YR 3/4 dry); silty clay loam; moderate fine granular to very fine subangular blocky; hard, firm, sticky, plastic; noneffervescent; very few thin argillan films; very few fine roots, few fine simple open pores; boundary clear and smooth. Lower portion of pre-Mazama (Stratum 21/22) soil.
23	**4Cb2**	Dark reddish brown to reddish brown (5YR 3/4 to 4/4 moist), reddish brown (5YR 4/3 dry); gravelly poorly-sorted coarse to fine sandy clay loam; moderate to strong medium subangular blocky; hard to very hard, friable to firm, very sticky, plastic; noneffervescent; common moderately thick argillan films, pore fillings and bridges; common fine roots, common fine simple and dendritic open pores; boundary abrupt and smooth. This layer may represent slopewash intervals of reddish sediment derived from erosion of strata 5/6 or 21 materials.
24	**6A/Bb3**	Dark reddish brown to reddish brown (5YR 3/4 to 4/4 moist), reddish brown (5YR 4/3 dry); gravelly poorly-sorted coarse to fine sandy clay loam; moderate to strong medium subangular blocky; hard to very hard, friable to firm, very sticky, plastic; noneffervescent; common moderately thick argillan films, pore fillings and bridges; common fine roots, common fine simple and dendritic open pores; boundary abrupt and smooth. Similar to Stratum 23. This layer may represent slopewash intervals of reddish sediment derived from erosion of strata 5/6 or 21 materials.
25	**4Cb2**	Dark yellowish brown (10YR 3/4 moist), pale brown to light yellowish brown (10YR 6/3 to 6/4 dry); moderately-sorted fine to very fine loam; moderate medium angular blocky to massive; hard, firm, slightly sticky, slightly plastic; non- to very slightly effervescent; common fine pores, common very fine to fine simple and dendritic open pores, abundant fine to coarse insect and rodent burrows; boundary clear and smooth. Soil and insect reworked Mazama ash (6850 B.P.). Occurs below Stratum 2 in several trench exposures and soil cores across site.
26	**9Btb5**	Olive (5Y 4/4 moist), olive (5Y 5/4 dry), with very distinct yellowish red (5YR 4/6 moist) root mottling and root traces; clay loam; strong medium subangular prismatic to blocky; very hard, very firm, sticky, plastic; slightly effervescent; common moderately thick argillan films and pore fillings; very few fine roots, few very fine simple opens and closed pores; boundary abrupt and smooth. Parent material of fine alluvium. Gleyed paleosol near base of `gully section'.

These master and subordinate soil horizon designators allow for sequential labeling of both soil horizons and sediment units, which, as noted above, may occupy coincident positions in the stratigraphic profile because soil horizons develop in sediments as well as on them. For example, Stratum 2b and the underlying Stratum 4a were not sequentially numbered in the field, but in the soil stratigraphic series they are, as 3Bwb2 and 4Cb2, respectively; and they both possess horizons of the b2 paleosol. Stratum 2b is composed of the third parent material (3) encountered from the surface (one of eleven recognized) and is an incipient illuvial soil horizon (Bw) within the second buried soil at the site (b2). Stratum 4a, therefore, is developed in the fourth parent material type below the surface (4), is part of a weakly pedogenically-affected soil horizon (C), but is also part of the second buried soil profile (b2). It should also be noted that, depending upon the stratigraphic exposure considered, one or more of the vertical subdivisions in the master stratigraphic series may be absent or only poorly expressed. Using Figure 17 and Table 2 as guides, the master stratigraphic sequence can be described as follows.

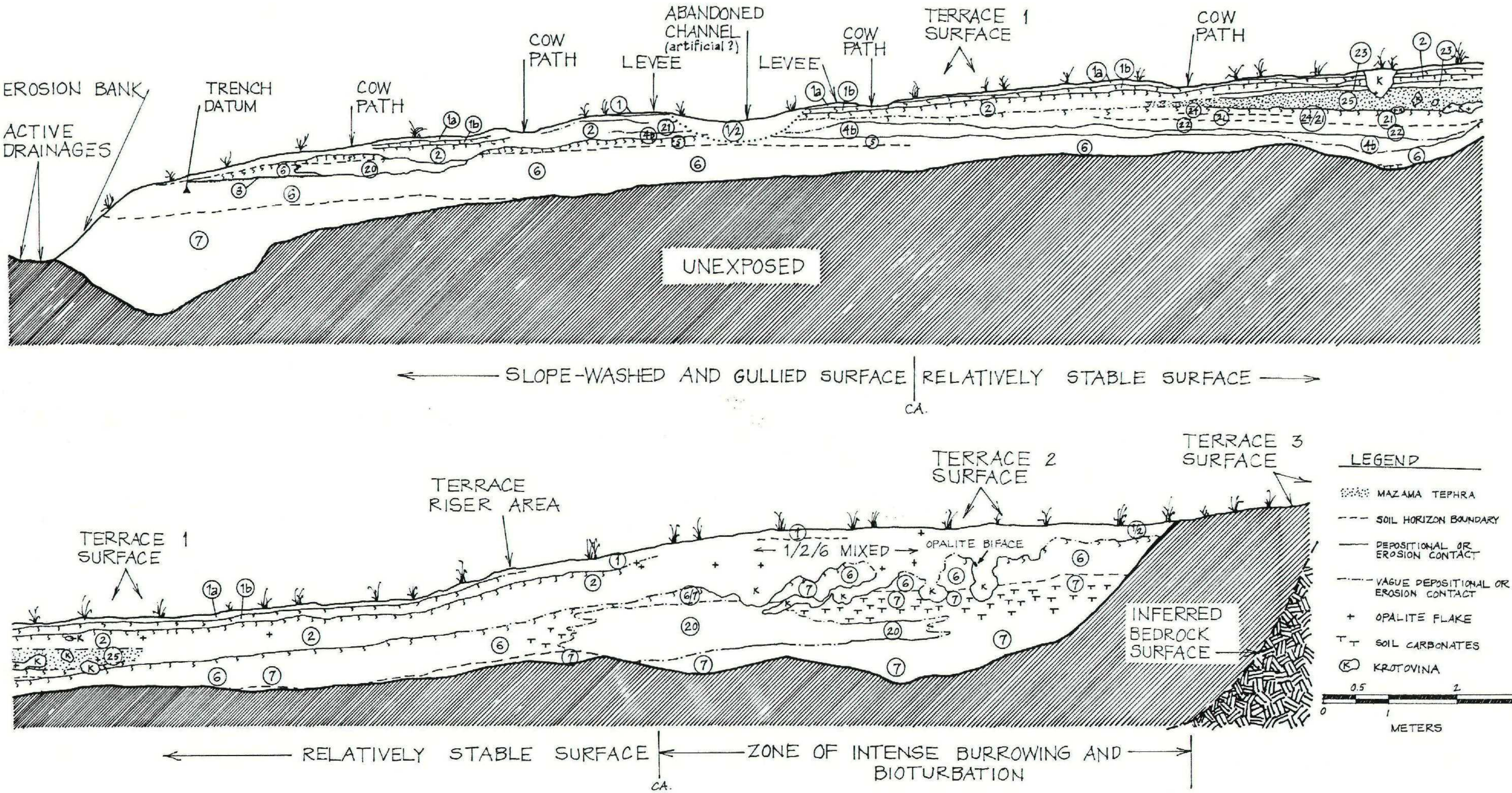

Figure 18. Trench F stratigraphic profile; west wall.

Stratum 1a (A) is the dark grayish brown eolian and slopewashed silt loam surface component of the site. A limiting date for the deposition of Stratum 1a is given by a hearth (cf. Figure 23) found at the surface of 1b in Trench B (Appendix H), which has been dated at 850±200 B.P. (Appendix C).

Stratum 1b (2A/Eb1) is part of both a buried (b1) soil and the modern soil. Notable changes in the vertical distribution of lithic material qualities and types, occurring in several excavation units (N1, AF1, AH2, AJ1, AI1, AL1, AM1, and AN1) near the surface of Stratum 1b (see below) probably are related to the depositional break between Stratum 1a and Stratum 1b.

Stratum 1c (2B/Cb1) is a dark reddish brown, sandy alluvial gravel buried (b1) soil horizon, exposed only in the gully section (cf. Figure 16) below the earthen dam. It probably correlates with Stratum 1b.

Stratum 2a (3Ab2) is a dark brown, moderately-sorted, very fine silty clay loam which marks the buried surface of the b2 paleosol. In places, it is also part of the B horizon of the modern soil.

Stratum 2b (3Bwb2), a dark brown, moderately-sorted, very fine silty clay loam, is the buried B horizon of the b2 paleosol as well as part of the modern soil B horizon.

Stratum 3a (3Ab2) and **Stratum 3b (3Bwb2)** are dark reddish brown to yellowish brown, poorly-sorted, sandy clay loams that are equivalent to Stratum 2, but confined to the gully section (cf. Figure 16); they are derived from alluvium parent material rather than from eolian or slopewashed silts. Stratum 3a is part of the b2 paleosol in the gully section and has been radiocarbon dated by soil carbon average mean residence time to 4380±90 B.P. (Beta-71239)(Appendix C).

Next in the soil stratigraphic sequence, **Stratum 23 (4Cb2)** is a dark reddish brown to reddish brown, poorly-sorted, coarse to fine sandy clay loam with gravel. This layer is comprised of clay-rich slopewashed sediments derived from erosion of strata 5/6 and 21 materials.

Stratum 4a (4Cb2), underlying either Stratum 2b or Stratum 23, is a reddish brown to yellowish red, gravelly, poorly-sorted, very coarse to fine sandy clay loam. As with Stratum 23, it is derived from eroded soil clasts and gravelly slopewash sediments. It is a transitional soil horizon to the Stratum 25 ash layer. A mixed combination of Stratum 4a and Stratum 25 occurs directly below Stratum 2 in several trench exposures and soil cores across the site.

Stratum 25 (4Cb2) is a pale brown to yellowish brown, moderately-sorted, fine to very fine loam composed of mixed silt and volcanic Mazama ash (6850 B.P., Appendix D). It typically appears throughout the site as a turbated and pedogenic mixture of ash and eolian silt, often difficult to recognize as a separate stratum. The best preservation of Mazama ash (Stratum 25) is limited to the area below Terrace 1 above the southern drainage where it is distinctly more ashy in appearance (see Trench F, Figure 18). While Stratum 25 and Stratum 4b contained archaeological materials in some excavation units (AG1, AH2, P1, Y1), these sediments are extensively turbated by insect burrowing and an assumed Mazama or pre-Mazama age for accompanying artifacts is only speculative.

Stratum 24 (6A/Bb3) is a dark reddish brown to reddish brown, poorly-sorted, coarse to fine sandy clay loam with common gravel. This layer may represent intervals of reddish sediment slopewash derived from erosion of strata 5/6 or 21 materials.

Stratum 21 (6A/B2b3) and **Stratum 22 (6Btb3)** are both dark reddish brown silty clay loams that occur between strata 24 and 4b. They represent the pre-Mazama b3 paleosol, found only in the Trench F exposure (cf. Figure 18) and adjacent soil cores.

Stratum 4b (6B/Cb3) is a dark brown, gravelly, moderately-sorted, coarse to fine sandy clay loam with pinkish gray (7.5YR 7/2 moist) spotty mottling. In Trench F (cf. Figure 18), Stratum 4b is part of the b3 buried soil which underlies Stratum 21 and possibly part of a cummulic mollic surface horizon or an extremely eroded duric debris derived from the b4 paleosol.

Stratum 5 (7Ab4), a black to dark reddish brown, slightly gravelly, well-sorted, very fine silty clay, comprises the organic-rich upper portion of the Pleistocene-age(?)(Soil Survey Staff 1980), b4 lower paleosol in the gully section.

Stratum 6 (7Bt(k)b4) is the subsoil of the b4 paleosol and is a yellowish red to strong brown to dark yellowish brown (colors varying according to degree of oxidation relative to local groundwater levels), slightly gravelly, well-sorted, very fine silty clay. Stratum 5 grades into Stratum 6, and the actual contact is difficult to detect in most soil cores.

In Trench C (cf. Appendix H), **Stratum 13 (7B/Cb4)** and **Stratum 14 (11R)** represent the weathering float zone below Stratum 5/6 and Stratum 1/2 materials; appearing as reddish brown silty clays with abundant angular weathered bedrock clasts, and white to yellow, rhyolitic tuff bedrock with cherty fine-bedding alternating with chalky to welded ash-fall beds. This float zone dominates the highest portions of much of the Terrace 2 and Terrace 3 areas of the site.

Stratum 7a (Ckb4) and **Stratum 7b (7Ckb4)** are yellowish red and reddish brown clay loams with very pale brown carbonate mottles and stringers. They are part of the C horizon of the lower b4 paleosol in the gully section.

Stratum 20 (7Ck2b4), a dark reddish brown to yellowish red, poorly-sorted, gravel to fine sand, occurs between Stratum 7a and Stratum 7b in a portion of Trench F (cf. Figure 18).

Stratum 8 (8Ccgb4), a black to dark reddish brown, moderately-sorted, sandy loam, occurs as a series of manganese staining layers throughout the site. It is probably a feature of water table fluctuation and post-dates most other soil horizons (cf. Trench F, Figure 18; Figure 16; and trenches D and E, Appendix H).

Stratum 10 (8Ccgb4) is similar to Stratum 8.

Stratum 9 (8Ckb4) is a carbonate-rich Ck horizon of b4 lower paleosol in the gully section. It is a dark brown to light brown, gravelly, moderately well-sorted medium to fine sandy clay loam with very pale brown carbonate stringers and mottled patches. Stratum 11 (8Cckb4) is similar to Stratum 9.

Stratum 12a (8Cgb4) is a dark brown to light brown, gravelly, moderately-sorted, medium to fine sandy clay loam and is part of the gravel-rich C/R buried b4 soil of the gully section (cf. Figure 16). Strata 15 through 19 (8Cgb4), which are equivalent to Stratum 12a, are dark brown, to light brown gravelly, moderately well-sorted, medium to fine sandy clay loams found variously throughout the site.

Stratum 26 (9Btb5) is an olive colored clay loam with very distinct yellowish red root mottling and root traces. This is the gleyed b5 paleosol found near the base of gully section.

Stratum 12b (10Cgb5) is similar to Stratum 12a but is part of the b5 paleosol.

In summary, the master stratigraphic section represents this sequence: deposition of tuff bedrock and early Terrace 3 formation; deposition of gravelly alluvium and sandy clay parent materials 10 and 9; formation of the b5 soil (9Btb5 and 10Cgb5); deposition of alluvial parent materials 8 and 7;

formation of the b4 paleosol (7Ab4, 7Btkb4, 7B/Cb4, 7Ckb4, 7Ck2b4, 7Ck3b4, 8Ccgb4, 8Ckb4, 8Ccgb4, and 8Ckb4); erosion of the Terrace 2(?) landform, deposition of parent material 3, and the beginning of Terrace 1 accretion; formation of the b3 soil (6ABb3, 6A/B2b3, 6Btb3, and 6B/Cb3); deposition of Mazama ash (parent material 5); erosion of Terrace 1 landform and deposition of parent material 4; deposition of parent material 3; formation of the b2 paleosol (3Ab2, 3Bwb2, 4Cb2, and 5Cb2); deposition of lower parent material 1 (Strata 1b and 1c); formation of the b1 buried soil (2A/Eb1 and 2B/Cb1); deposition of upper parent material 1 (Stratum 1a); and formation of the modern soil (A) and recent stream channel erosion.

The minimum ages for soil formation episodes recognized here (at ca. 7000 B.P., ca. 4380 B.P., ca. 850 B.P., and recent soil), are very similar to those recognized at Susie Creek, Nevada (at ca. 7500 B.P., ca. 3500 B.P., ca. 1000 B.P, and recent) (Niles 1994) and in southeastern Oregon (at ca. 8000 B.P., ca. 4700 B.P., ca. 1000 B.P., and recent)(Dugas and Bullock 1993; Dugas 1994). These similarities may represent a regional tendency toward soil formation at similar times, or at least the cessation of soil formation by sediment burial at similar times.

Site Formation Processes

In general, stream alluviation and erosion appear to have been the dominant geomorphic processes during the Pleistocene. During the Holocene, eolian silt and ash accretion, colluvial slopewash, and bioturbation become more important site formation processes. Soil textural variation, due to a combination of locally intense bioturbation (cf. Figure 18, north end of Trench F), movement of fines by slopewash and wind activity, and clay shrink/swell, are perhaps one of the most noticeable site sediment characteristics. Generally, the soil texture of the soil surface ranges between Holocene-age, granular-structured, eolian silts of Strata 1 and 2; and clay-rich exposures of mixed surface silts and b4, b2, and b1 paleosol materials (Strata 1b, 1c, 2, 4a, 5, 6, 7, and 25). Sediments appear to have been eroded most extensively from the surfaces of Terrace 2 and Terrace 3, then redeposited on the Terrace 1 surface. The most intense mixing, by pedogenesis and bioturbation of sediments, has occurred on the slopes occupied by Terrace 2 and the transition zone between Terrace 2 and Terrace 3. This was most clearly observed in Trench F at its northern end (cf. Figure 18). Fortunately, in terms of archaeological recovery, much of this mixing appears to have affected sediments below Stratum 2. In terms of surface erosion, portions of Terrace 1 adjacent the drainages are the areas most heavily affected by gullying and surface wash. This has resulted in the disturbance of several archaeological features along the southern edge of the site.

In order to better define the potential extent and depth of artifact-bearing sediments, an isopach map was constructed (Figure 19) showing the distribution and thickness of Holocene-age sediments and soils which overlie the b4 Pleistocene-age paleosol. Typically, the thickest areas of Holocene fill occur below the Terrace 1 surface (cf. Figure 18 also), especially along the southern flank of the south ridge. Deep sediments also appear below the Terrace 2 surface on the northern flank of the south ridge.

The isopach map was constructed coincident with data recovery excavations, recognizing that excavation unit placement would, in part, be based on early recognition of the varying thicknesses of archaeologically-significant, Holocene sediments. Comparison of the isopach map and terrace extent also serves to illustrate the dynamic nature of the geomorphic processes which have affected the history of site formation. The deeper Holocene fill areas (cf. Figure 19) northwest and southeast of Trench B (cf. Figure 13), for example, suggest that the northern stream channel may have traversed the site at this point in the past to join the southern ridge in the areas of Unit Y1 (cf. Figure 10) rather than at the extreme southeast end of the site. This channel cutting has, in the process, isolated a small, shallowly buried, bedrock knoll (Figure 19, and Trench C in Appendix H) in the area of blocks R, T, and V (cf. Figure 10).

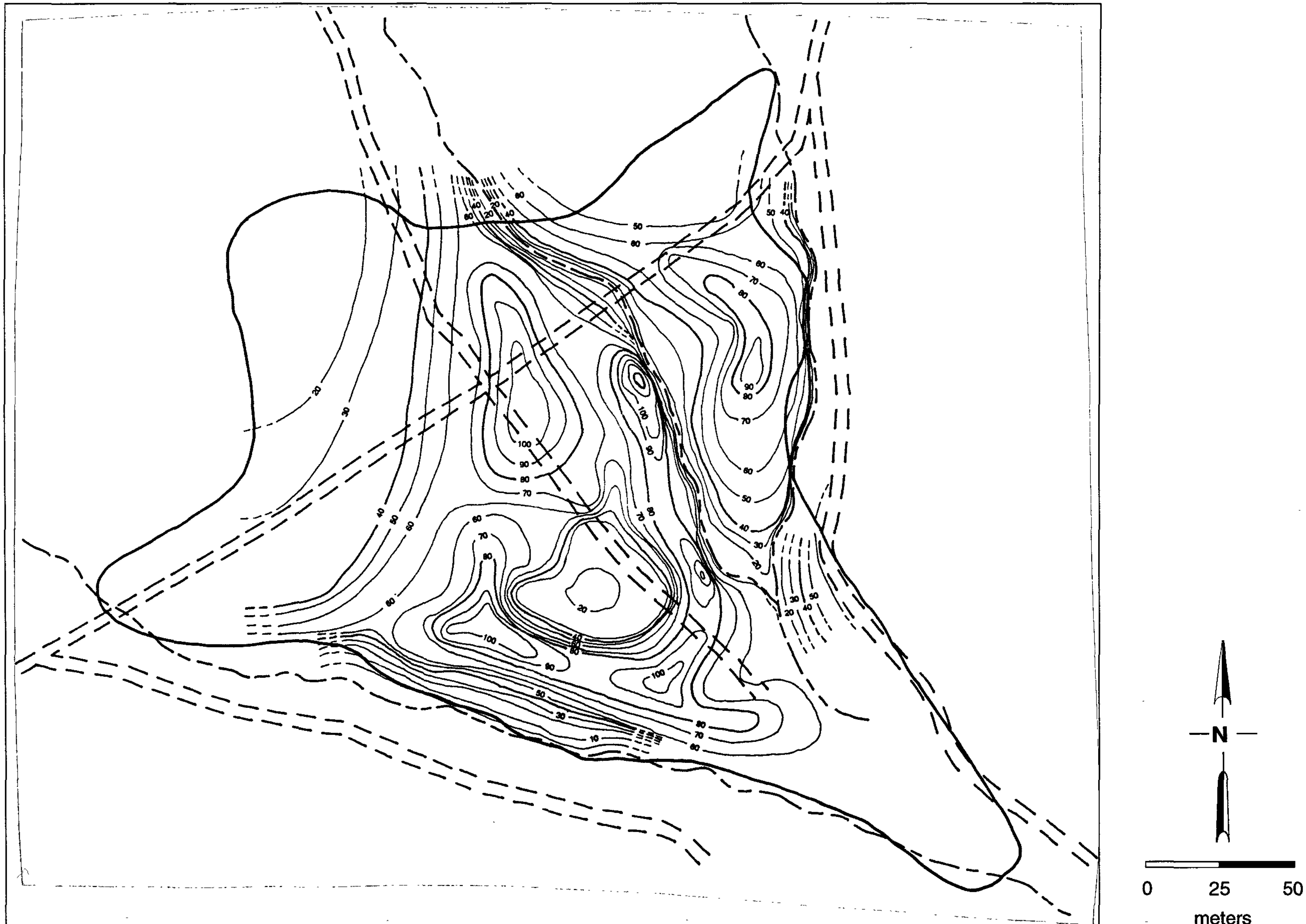

Figure 19. Isopach map of 26Ek5040 from ground surface to stratum 5/6 surface showing thickness of Holocene fill; contour interval is ten centimeters.

The geomorphology and stratigraphy discussed above illustrate the complex character of the formation processes and resultant setting of 26Ek5040. At least three depositional events alternating with four individual soil episodes within the Holocene (including the modern soil) has fostered preservation of occupation surfaces and archaeological features, and the combination of terrace surfaces and multiple sediment and soil layers has allowed for several artifact contexts to exist.

Surface Features

Although not all surfaces within the bounds of 26EK5040 were covered with a continuous scatter of debitage, large areas did exhibit debitage at relatively low density. At 26Ek5040, bounded areas where debitage density exceeded the local low density background were defined as features. Clusters of debitage of a common (i.e., one) toolstone material, were also treated as features. We recognize that defining features in this way should favor those that are most recent, or located in places most protected from cultural, biological, and geological processes. In the fullness of time, surface features are likely to be dissipated or buried. Features 2 and 3 for example, were noticeably less dense during excavations in June 1994 than described in 1992. But features that are visible now may represent loci of individual acts of toolstone reduction, and thus contain more specific information on technological processes and their distribution across the site than samples of the background scatter.

Surface cultural features on site 26Ek5040 form three clusters (cf. Figure 8). The northern cluster is on the crest of the northernmost interfluvial ridge, the central group is on the crest of the southern ridge, and the southern group is along the south flank of the southern ridge overlooking the intermittent stream. The northern feature group is located wholly on Terrace 2, while the southern group is only on Terrace 1. Members of the central feature group, however, are found on all three terraces. Since preliminary analysis of features by geomorphic position failed to demonstrate significant patterning, the following discussion refers to features in terms of spatial groups. Observations of surface feature composition, size, and density recorded before excavation are provided in Table 3; excavation data are provided in Table 4 and Table 5.

Northern Group

The northern group comprises nine features (1 through 8, and 31) located on a relatively flat portion of the northern ridge. Eight features are tightly clustered in an area about 25 by 40 m; Feature 1 lies somewhat isolated on the edge of the flat about 20 m south of the main group. Features 4, 6, and 7 were tested in 1992 (Ataman et al. 1992). Features in this group were the smallest in area (mean 22.6±29.3 m^2). Surface debitage in most (n=8) features of this group appeared dominated by opalite, although the proportion of obsidian in Feature 3 was estimated at forty percent (cf. Table 3). Surface debitage density varied among features from 10 to 100 flakes per square meter (cf. Table 3). Formed flaked artifacts were not common in surface features of this group (0.3 per feature); only a scraper, a biface, and an Elko point (cf. Table 3) were recovered, and groundstone artifacts were limited to two metate or mano fragments not in surface features. In the opalite samples recovered from surface scrapes, mean fraction of heat treated debitage in the northern group was 56.97±16.7 percent; mean fraction of colored chert was 18.41±14.6 percent. There is a narrower segment of the reduction sequence present in the 57 opalite debitage samples from surface contexts in this feature group, compared to the central and southern groups. Less core reduction and less retouch/finishing are present perhaps attributable to the smaller sample size of the northern group.

Table 3. Surface Feature Data Summary.

Feature #	Units	Size (m^2)	Material (%)	Maximum Density (flakes/m^2)	Tools	Description
North Group						
1	J1-J3	9.4	100% OP	10		Diffuse scatter, biface thinning flakes dominate; denser in 1992.
2	K1-K3	9.4	100% OP	10		Small diffuse scatter of blank preparation and thinning flakes; more distinct in 1992.
3	L1-L4	99	60% OP; 40% OB	8--obsidian; 30+--opalite	Opalite scraper; Obsidian Elko	Sparse scatter of obsidian debitage within opalite scatter overlaping with WSW edge of Feature 4.
4	1992 Test	24	98% OP; 2% OB	80	1 biface	Discrete dense scatter of opalite debitage; mid-stage thinning.
5	M1-M2	39.3	100% OP	40		Large opalite biface thinning debitage present. Appears to be eroding out of hill. Obsidian flake collected from surface.
6	1992 Test	10.5	90% OP; 10% OB	40		Small, med. & large debitage; mid/late biface thinning; little heat-treatment; obsidian mostly pressure flakes.
7	1992 Test	1.8	100% OP	100+		Dense scatter of mostly small to medium debitage; mid-stage reduction; some heat treatment.
8	N1-N3	21.2	99% OP; 1 % OB	100		Concentration of thinning flakes; may represent a single reduction event.
31	AE1-AE3	3.5	100% OP	75		Small, dense, white opalite scatter of thinning flakes.
Central Group						
9	O1-O3	11	99%OP; 1% BA	50	4 bifaces; 1 flake tool	Diffuse scatter of late stage opalite thinning flakes.
10	P1-P3	314	99% OP; 1% OB	50		Long narrow scatter with dense and diffuse areas. Primarily late stage debitage.

Table 3, continued.

Feature #	Units	Size (m^2)	Material (%)	Maximum Density (flakes/m^2)	Tools	Description
11	Q1-Q8	55	100% OP	40	1 pc. groundstone, 1 scratched stone, FCR	Diffuse scatter of multi-colored opalite thinning flakes. Some cobble reduction. Numerous FCR.
12	AN1	6.2	100% OP	Not given	1 biface, 1 Gatecliff point	Scattered around feature surface. Excavated in 1992. Dense, small scatter of opalite thinning debitage.
13	R1-R4	189	99% OP; 1% OB	50	6 bifaces	Large diffuse scatter of predominantly white opalite. Mostly middle stage reduction.
15	T1-T3	353	99% OP; 1% OB	100	3 bifaces	Large, dense late stage opalite scatter. Small cluster of tin cans on NE edge.
16	U1-U2	15.7	99% OP; 1 % OB	15	1 flake tool, 1 biface	Small diffuse concentration within a moderate density scatter. Predominantly white opalite thinning flakes. Feature is on slope--disturbed?
17	V1-V4	28.3	99% OP; 1% OB	75	3 bifaces	Small, dense opalite scatter of thinning flakes. Obsidian flake collected from surface.
18	1992 Test	13.5	100% OP	50	1 scraper, several tin cans	Small. med. & large debitage of various materials; mid/late stage reduction; some heat treatment.
19	1992 Test	2.2	100% OP	30	1 biface, 2 cans	single FCR with associated lithic scatter and historic cans F18).
20	Historic scatter, not excavated					19 cans, 4 glass frags.dump along drainange; includes coffee and milk cans.
26	Z1-Z2	28.3	95% OP; 1% OB; 1% BA	75		Mlulticolored and white opalite flakes. Primarily large, late thinning flakes.
27	AA1-AA2	31	100% OP	30	1 biface	Small scatter of white and multicolored opalites. Primarily mid to late reduction in range of sizes.
30	AD1-AD3	19	99%OP; 1%OB	70	3 biface	Dense scatter of large thinning flakes of white and colored opalites. Obsidian flake collected from surface.
32	AF1-AF3	31.4	100% OP	20		Small scatter consisting almost entirely of late stage biface thinning flakes. May be a single reduction episode.

Table 3, continued.

Feature #	Units	Size (m^2)	Material (%)	Maximum Density (flakes/m^2)	Tools	Description
South Group						
14	S1-S3	19	99% OP; 1% OB	20	1 biface	White opalite scatter. Mostly thinning flakes. Obsidian flake collected from surface.
21	W1-W3	47	100% OP	40	2 bifaces	Locally dense, fairly discrete scatter of opalite thinning flakes. Possible single reduction event.
22	X1-X4	283	100% OP	60	1 preform, 1 point fragment, 4 bifaces, 1 hammerstone	Large, fairly sparse scatter of mostly white opalite thinning flakes with some core reduction. Amorphous boundaries.
23	1992 Test	5.2	100% OP	80	3 bifaces	Two dense loci within a sparse scatter; small, discrete; mostly white, large, med & small debitage; mid-stage reduction, some heat treatment; effects of slope wash evident
24	1992 Test	36	100% OP	150	8 bifaces, 1 flake tool, 1 Gatecliff point, 1 grndst. frag, 1 ob. flake	Two dense loci within a sparse scatter; mostly white with some yellow & pink; early middle and late reduction; some heat treatment.
25	Y1-Y2	31.5	100% OP	100	5 bifaces	Multiple reduction stages present including several small single reduction events. Several colors of opalite present.
28	AB1-AB2	14.1	100% OP	25	1 biface, 1 obsidian projectile point	Small lithic scatter of primarily white opalite with some other colors. Mostly late thinning, some pressure flakes.
29	AC1-AC2	1.6	50% OP; 50% BA	10	Elko point	Very small flake cluster at head of small runoff channel. Basalt may be from single reduction episode. Basalt flakes are cobble reduction, opalite are thinning.

OP=Opalite; BA=Basalt; OB=Obsidian

Table 4. Debitage Samples from Surface Scrapes.

Group	Feature	Excavation Unit	% Heat treatment	% Color	Opalite Technological Characterization†	Size Grade--% of Sample G0	G1	G2	G3	G4	Comments
Northern	1	J1-1	30	7.2	bE*LR	0	15.6	54.4	28.4	1.5	
		J2-1	70	2	E1	0	0	16.5	81.7	1.8	
		J3-1	60	20.6	bl	0	0	47	46.5	6.5	Obsidian--0.58%
	2	K1-1	35	13.1	elr	0	0	54.6	43.4	1.9	Obsidian--1.9%
		K2-1	40	75.8		0	49.4	20.6	10.6	0	
		K3-1	30	13/6	bEL	0	0	40.2	56.5	3.3	
	3	L1-1	70	9.2	belR	0	36.5	29	27.9	6.5	Obsidian--0.5%
		L2-1	55	13.4	clR*	0	0	39.7	49.4	10.9	Obsidian--0.51%
		L3-1	70	17.6	E lR	0	0	53.9	37.2	8.9	Obsidian--0.24%
		L4-1	70	7.8	celR	0	0	53.2	34.5	12.3	Obsidian--0.9%
	5	M1-1	55	2.9	BEL	0	36.5	41.3	21.5	0.7	
		M2-1	60	14	bEL*r	0	0	56.9	40.2	2.8	
	8	N1-1	70	0	cBElr	0	24.8	49.5	24.4	1.3	Outre passe flake
		N2-1	80	1.8	cBEL*r	0	12.2	56.2	30	1.6	
		N3-1	85	4.5	cBEL*r	0	17.8	52.3	28.1	1.8	
	31	AE1-1	40	1.4	bE*lr	0	46	41.9	11.6	0.5	
		AE2-1	50	0.9	bE*lr	4.4	38.2	42.5	14.5	0.4	
		AE3-1	55	3	bE*lr	0	59.6	25.8	13.9	0.6	
Central	9	O1-1	80	20	beLR	0	0	40.2	58.4	1.3	
		O2-1	80	20.1	cbElR	0	0	48.2	50.7	1.1	
		O3-1	75	33.6	CBELr	0	12.6	39.8	46	1.7	Basalt--0.16%
	10	P1-1	80	16.9	cBElr	0	8.7	38.5	51.5	1.2	
		P2-1	85	18.5	R	0	0	52.3	45.9	1.8	Obsidian--0.22%
		P3-1	75	8.8	r	0	32.7	29.7	35.9	1.7	
	11	Q1-1	70	43.5	cBELr	0	25.3	37.3	35.6	1.8	Obsidian--0.07%
		Q2-1	50	47.8	cBElr	0	19.3	53.8	25.6	1.3	
		Q3-1	40	44	cbE*lr	0	25.4	37.2	36.3	1.1	

Table 4, continued.

Group	Feature	Excavation Unit	% Heat treatment	% Color	Opalite Technological Characterization†	Size Grade--% of Sample G0	G1	G2	G3	G4	Comments
	11, cont.										
		Q4-1	60	21.6	cbE*Lr	0	29.9	41.9	26.7	1.3	Obsidian--0.08%
		Q5-1	60	31.7	cBELr	0	0	58.3	39.4	2.2	Obsidian--0.31%
		Q6-1	75	24.4	bElr	0	4.3	45.9	47.4	2.3	Obsidian--0.26%
		Q7-1	65	37.2	bELr	0	0	49.1	47.9	2.9	
		Q8-1	65	35.3	B*ELR	0	16	37	45.4	1.6	Obsidian--0.15%
	12	AN1-1	85	13.2	BE*LR	0	21.3	38.7	37.6	2.3	Obsidian--0.05%; Bipolar flake
	13	R1-1	65	30.2	CBeLr	0	14.2	41.2	42	2.6	Obsidian--0.11%; Basalt--0.69%; Some burning
		R2-1	75	43	cbELr	14.9	7.4	35.3	40.4	2.1	
		R3-1	65	27.7	cbElr	0	0	56.3	40.9	2.8	Obsidian--0.11%
		R4-1	50	38.4	CbElr	0	16.6	39.2	43.1	1	Some burning
	15	T1-1	65	10.6	cbElr	0	13.1	57.9	28.1	0.9	Some burned pieces
		T2-1	65	4.6	cbELr	0	13.2	54.5	31.6	0.6	
		T3-1	60	11.7	cbELr	0	11.8	58.3	29	0.8	Some burned pieces
	16	U1-1	40	27.2	cbEl	0	0.01	59	38	3	
		U2-1	60	12.4	cbElr	0	21.8	33.2	43.6	1.4	
	17	V1-1	75	17.6	cbElr	0	15.8	61	36.9	1.1	Some burned pieces
		V2-1	60	16.4	cbElr	0	18.8	47.4	32.6	1.1	Obsidian--0.05%
		V3-1	60	15.4	cBE*L	0	20.8	41.5	36.7	0.9	Obsidian--0.13%
		V4-1	70	15.9	cbE*lr	0	14.4	48.7	35.4	1.5	Obsidian--0.02%
	26	Z1-1	60	32.4	cbEL	0	0	31.2	65.8	3	Obsidian--0.06%
		Z2-1	60	16.4	cBElr	0	13.8	33.1	51.5	1.5	Burning present
	27	AA1-1	80	30.6	cBElr	0	39.4	34.8	25.2	0.5	Heat failed pieces
		AA2-1	80	13.7	bE*Lr	0	11.7	16.4	69.1	2.7	Obsidian--0.07%; Basalt--0.01%; Burning
	28	AB1-1	60	27	bE*lr	0	7.6	57.1	34	1.3	Obsidian--0.14%; Basalt--0.14%; Burning
		AB2-1	50	34.1	BElr	0	0	40.9	56.9	2.2	
	30	AD1-1	65	16.4	BE*Lr	0	24.2	27	47.9	0.9	Obsidian--0.11%
		AD2-1	70	15.8	CBE*Lr	0	20.1	16.1	51.6	12.1	Obsidian--0.02%; Basalt--0.02%
		AD3-1	70	30.2	cbELr	0	7.7	40	50.6	1.7	Obsidian--0.21%; Basalt--0.13%; Burning

Table 4, continued.

Group	Feature	Excavation Unit	% Heat treatment	% Color	Opalite Technological Characterization†	Size Grade--% of Sample G0	G1	G2	G3	G4	Comments
	32	AF1-1	95	2.8	EL	0	0	78.8	20.3	0.8	
		AF2-1	85	7.6	EL	0	0	31.8	63.8	4.3	
		AF3-1	90	16.6	L	0	0	56.8	43.2	0	
Southern	14	S1-1	70	6.6	cbE*Lr	0	14.6	47.6	37	0.8	Obsidian--0.07%
		S2-1	65	4.6	cbElr	0	10.3	55.3	33.6	0.7	
		S3-1	65	3.4	bElr	0	20.8	42.3	35.2	1.6	Some burning
	21	W1-1	98	0.4	bELr	0	17.9	55.7	25.5	0.8	
		W2-1	98	9	cbELr	0	23.2	35.4	40.4	0.9	
		W3-1	95	7.3	bELr	0	14.7	47.8	37	0.4	
	22	X1-1	65	7.2	cBE*L	0	26.3	40.8	32.1	0.8	
		X2-1	90	13.7	bEL*r	0	13.1	46.8	38.2	1.9	
		X3-1	75	11.5	EL*	0	0	60.5	39	0.5	Some burning
		X4-1	60	17.4	bE*lr	0	8.2	36.6	54	1.1	
	25	Y1-1	75	11.7	B*Elr	0	14.1	54.4	30.4	1.1	Obsidian--0.18%
		Y2-1	70	4.5	B*Elr	0	27.3	52.1	20.2	0.4	Obsidian--0.09%
	26	Z1-1	60	32.4	cbEL	0	0	31.2	65.8	3	Obsidian--0.06%
		Z2-1	60	16.4	cBElr	0	13.8	33.1	51.5	1.5	Burning present
	27	AA1-1	80	30.6	cBElr	0	39.4	34.8	25.2	0.5	Heat failed pieces
		AA2-1	80	13.7	bE*Lr	0	11.7	16.4	69.1	2.7	Obsidian--0.07%; Basalt--0.1%; Burning
	28	AB1-1	60	27	bE*lr	0	7.6	57.1	34	1.3	Obsidian--0.14%; Basalt--0.14%; Burning
		AB2-1	50	34.1	BElr	0	0	40.9	56.9	2.2	
	29	AC1-1	70	4.4	belr	0	0	27.4	50.6	22	
		AC2-1	60	13.8	beLR	0	0	21.7	75.8	2.4	Basalt--26.1%

†c=core reduction; b=blank preparation; e=early thinning; l=late thinning; r=retouch
Lower case--minor component, Capital letter=common component, Emphasized capital--dominant

Table 5. Flaked Stone Artifacts Recovered from Feature Contexts.

	Indeter.	Late 2	Early 3	BIFACE STAGES Mid 3	Late 3	Early 4	Late 4	Early 5	Late 5	Flake Tool	Core/ Mod. Chunk	Preform	Point	Total	Projectile Pt.
South Group															
Feature 14 (S)				3			1			2				6	
Feature 21 (W)	3				1					3				7	
Feature 22 (X)	5		1	1	5	1	1			2		1	2	19	2 Opalite Frags.
Feature 25 (Y)	1	2	1	4	2	3		1		1				15	
Feature 29 (AC)	3						2				1		1	7	Opalite Elko
	12	2	2	8	8	4	4	1	0	8	1	1	3	54	
	22.22%	3.70%	3.70%	14.81%	14.81%	7.41%	7.41%	1.85%	0.00%	14.81%	1.85%	1.85%	5.56%		
North Group															
Feature 1 (J)	1													1	
Feature 2 (K)	1	1												2	
Feature 3 (L)	1									2			1	4	Obsidian Elko
Feature 5 (M)	1			1	1					1				4	
Feature 8 (N)	8		1	1	1	1	1	2	1	5				21	
Feature 31 (AE)	8			3	1					1				13	
	20	1	1	5	3	1	1	2	1	9	0	0	1	45	
	44.44%	2.22%	2.22%	11.11%	6.67%	2.22%	2.22%	4.44%	2.22%	20.00%			2.22%		
Central Group															
Feature 9 (O)	3		1	1						5				10	
Feature 10 (P)	3		1	1		1				3	1		1	11	Opalite Frag.
Feature 11 (Q)	2	1		1	3		1	1		18	1		2	30	Opalite Elko, Opalite Out of Key
Feature 13 (R)	5		1		4		1	2	1	7	2		1	24	Opalite Frag.
Feature 15 (T)	4			4	2	1			1	2				14	
Feature 16 (U)			1		1					4				6	
Feature 17 (V)	7	2	1	1	3	1			1		1		1	18	Opalite Frag.
Feature 26 (Z)	3			1			1			1				6	
Feature 27 (AA)	6		2	1			2		1	8			1	21	Exotic Chert Frag.
Feature 30 (AD)	10		1	3	3		2	1		8			1	29	Opalite Elko
Feature 28 (AB)	1				1					1			1	4	Obsidian Out of Key
Feature 32 (AF)	1														
	45	3	8	13	17	3	7	4	4	57	5	0	8	173	
	26.01%	1.73%	4.62%	7.51%	9.83%	1.73%	4.05%	2.31%	2.31%	32.95%	2.89%		4.62%		

Central Group

The central group comprises the largest number (n=15) of surface features (9-13, 15-19, 26-28, 30 and 32). Most features were scattered for about 120 m down the axis of the southern ridge. Most lie on a flatter portion of the central ridge at about the same elevation as those in the northern group. Features 23 and 24 were excavated in 1992 (Ataman et al. 1992); these are not included in Tables 2 and 3. The largest features occurred in this group (cf. Table 3), but feature size was highly variable (mean feature area = 74.1±114.7 m2). Debitage in surface features of the central group was dominated by opalite, although several samples contained small amounts of other materials (cf. Table 3). Debitage density in this feature group ranged from 20 to 100 items per m2. Formed artifacts were relatively abundant (1.7 per feature) on the surface, including bifaces, flake tools, and projectile points; Features 15 and 17 were especially rich in bifaces (cf. Table 5; Ataman et al. 1992:Table 2). A scratched stone, a metate fragment, and a piece of fire cracked rock were found in Feature 11 (cf. Table 3).

Detailed information on the composition of the opalite debitage samples recovered from surface scrapes is given in Table 4. The mean fraction of heat treated debitage in the central group was 67.9±12.2 percent, while the percentage of colored chert was 22.0±12.2., the highest in both categories in any feature group. Features 15 (Block T), 17 (Block V), 14 (Block S), 21 (Block W), 25 (Block Y), and 29 (Block AC) are internally consistent in composition and technology suggesting each may represent one reduction episode. Feature 16 (Block U) however, was internally variable in technology and amounts of heat-treated and colored debitage (Ataman et al. 1992:25, Table 3). Obsidian flakes occurred in half (n=7) the central group features (Table 4). This group contained the highest number of debitage samples (n=163). The central group comprises the greatest range of the biface reduction sequence, with more core reduction here.

Southern Group

The southern group is comprised of eight features (14, 20-25, 29) on a low, bench-like terrace (Terrace 3) between the intermittent stream and the flank of the southern ridge. Historic Feature 20 (a can scatter) appeared in this group; without depth potential, it was not excavated. As in the central group, feature size varied (mean feature area = 60.5 ± 99.48 m^2). Opalite debitage dominated most surfaces, but Feature 29 contained fifty percent basalt (Table 3). Obsidian was the most common non-opalite material (with the exception of the high proportion of basalt in Feature 29) and surface tools were most abundant (2.9 per feature) in this group, including bifaces, a flake tool, a hammerstone, a preform, and an Elko point (cf. Table 5). Bifaces were particularly abundant in Features 22-25 (cf. Table 5; Ataman et al. 1992:Table 2).

In debitage samples from surface scrapes (cf. Table 4), mean fraction of heat-treated debitage was 58.8±32.9 percent; mean fraction of colored cherts was 14.0±10.5 percent. These values are very similar to those of the northern group; both are smaller than those of the central group. Little variability in debitage from scrapes (cf. Table 4) suggests that Features 14, (Block V), 21 (Block W), 25 (Block Y), and 29 (Block AC) are internally consistent in composition and technology, suggesting each represents one reduction episode. Feature 21 has a high percentage of heat-treated debitage relative to other features across the site. Features 22 (Block X), 23, and 24 were internally variable in technology and amounts of heat-treated and colored debitage (Ataman et al. 1992:25, Table 3). Significant quantities of basalt debitage were found only in Feature 29, a very small, sparse cluster of basalt and opalite reduction debitage containing an Elko point and few other tools (cf. Table 5). Its location at the head of a small surface runoff channel originally prompted us to think that the feature might have been eroded, but the internal consistency of both basalt and opalite technologies suggests remnants of the original feature (cf. Table 4). Seventy-five opalite samples were analyzed from this feature group. Most contain all or nearly all of the biface reduction sequence and do not differ markedly from the samples in the other feature groups.

Summary

Overall, four features (9, 11, 13, 28) contain noticeably high percentages of colored debitage; all four were part of the central group. Two of the three features which contain relatively large amounts of heat-treated debitage are in the southern group (Features 21, 22) and the third (Feature 32) in the central group, is on the northwest edge of the site. The internal consistency in technology and other characteristics of 15 features suggest single reduction events (Features 3, 5, 8, 9, 13, 14, 15, 17, 21, 25, 26, 28, 29, 31, 32). This consistency does not appear to be simply a result of sampling of a homogeneous background scatter. If that were the case we would expect more geographic clustering of this group (instead they occur across the site) and less variation among them in amounts of heat treatment and debitage coloration, non-local materials, and so forth.

The remaining 18 features are more difficult to characterize. Many likely represent a series of overlapping reduction events as evinced by the variability between samples from adjacent units and areas within larger features. Alternatively, some of these debitage clusters may be the result of geomorphic processes such as deflation or slopewash and may be mixed.

Percentages of heat-treated debitage are fairly high among most features at 26Ek5040, suggesting heat-treated materials were transported here for reduction or that heat treatment took place on site, although no unequivocal heat treatment hearths were located. In contrast, percentages of colored debitage are consistently low except in the features mentioned earlier, and even there percentages are modest (30-40%).

During the period of time represented by these surface features, the inhabitants of 26Ek5040 appear to have relied on a source of white opalite for the bulk of their toolstone. Non-opalite materials are fairly rare across the site, consisting of a very thin scatter of obsidian and a few sparse clusters of basalt. Obsidian is found in the largest relative amounts in features in the central group. Seven pieces of obsidian from surface features were subjected to hydration analysis. Samples from Features 2, 13, and 14 all had hydration rinds greater than 6.0 microns, while those from Features 11, 17, and 25 ranged from 1.4 to 6 microns. The measurement of 4.8 microns on a piece from Unit Q8 is more characteristic of the rind from pieces in lower levels of that block; it may have been transported from below.

Basalt debitage was rare in surface feature samples at 26Ek5040 and was much earlier in stage than opalite debitage, consisting mainly of core reduction and blank preparation flakes. Obsidian tools appear to have been made primarily from small obsidian nodules (cf. discussion in Chapter 5).

Variation in some aspects of feature composition was also noted between feature groups. Though Middle and Late Stage 3 bifaces were the most common biface type recovered from all features, they were most common in features in the southern group. Figure 20 illustrates major differences between flaked stone tool assemblages of different feature groups: northern and southern feature group tool assemblages are quite similar, but that from the central group has fewer bifaces and flake tools, and slightly more projectile points. Percentages of colored debitage were much lower in the northern group surface scrapes and in the southern group excavation units. A consistent factor between groups was representation of the entire reduction sequence from blank preparation flakes to retouch flakes in most features. Core reduction debitage was also fairly common.

To explore whether certain stages of reduction were more common in particular parts of the site, the weight of each size-graded portion of the debitage samples was converted to a percentage (cf. Table 4) and compared within and among features and groups. Most samples are dominated by G2 (1/2 in) and G3 (1/4 in) debitage, but some minor variation is apparent in the larger and smaller debitage sizes (cf. Table 4). On Terrace 1, two features in the southern group (22, 25) and one in the central group (16) have units with slightly elevated G1 (1 in) percentages (>20%). Little G1 debitage was recovered from Feature 1, while elevated amounts were found in Features 5 and 31 (northern group). Relatively large amounts of G4 debitage (>5%) were found in Features 2 and 3 in the northern group, and Feature 30 in the central group. Feature 26 (central group) had a high percentage of G3 debitage. Finally, also in the central group, large percentages of G1 were found in Feature 10 coinciding with low percentages of G2 flakes. Features 11 and 32 (central group) were highly variable internally. The southern group, therefore, seems to contain a larger proportion of G1 debitage than the other groups. Conversely, proportionately higher percentages of G4 debitage were more common in the northern group.

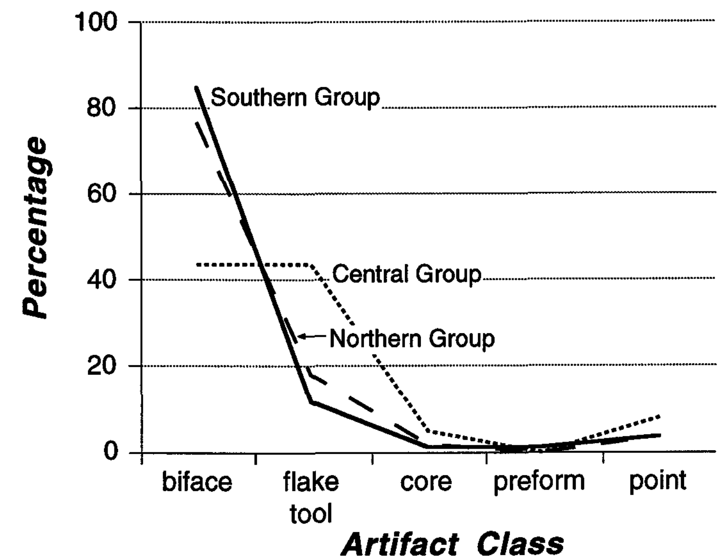

Figure 20. Artifacts recovered from feature contexts.

Analysis of the contents of surface features at 26Ek5040 shows some spatial variation in raw material use and tool manufacture and use/discard. This pattern suggests that activities on these surfaces may have varied through time or reflect internal site patterning. The following discussion explores variation in subsurface features.

Subsurface Cultural Features

In addition to the 32 surface features, nine subsurface features were encountered: one in Trench B, one in Block Q, one eroding from the wall of a 1992 test unit, and the remaining six in the mechanically scraped areas.

Feature 33 (Units Q5-Q8)

This cluster of fire-cracked rock (FCR) was uncovered during excavation of Feature 11 (Block Q), a diffuse surface opalite reduction scatter with groundstone and FCR (Figure 21). Excavation of Units Q5 & Q6 revealed a cluster of FCR 4-6 cm below the surface (Figure 22). Though charcoal flecks and burned flakes were noted in the screen, little charcoal was visible in the feature and flotation of soil samples returned insufficient charcoal for standard or extended count radiocarbon dating. Two fragmentary pieces of groundstone were associated with this feature, one a fire-cracked, highly polished fragment of basalt (Q6-2-1.4), and the other a moderately polished piece of welded tuff with an irregular use surface (Q5-2-2.1). Units Q7 and Q8 were excavated east and south, respectively, of this feature (cf. Figure 21), but contained only scattered pieces of FCR. The FCR cluster in Q5 and Q6 continued only to between 10 and 12 cm below surface (Appendix H, Figure H.5a). Debitage and tool counts also dropped sharply below this level.

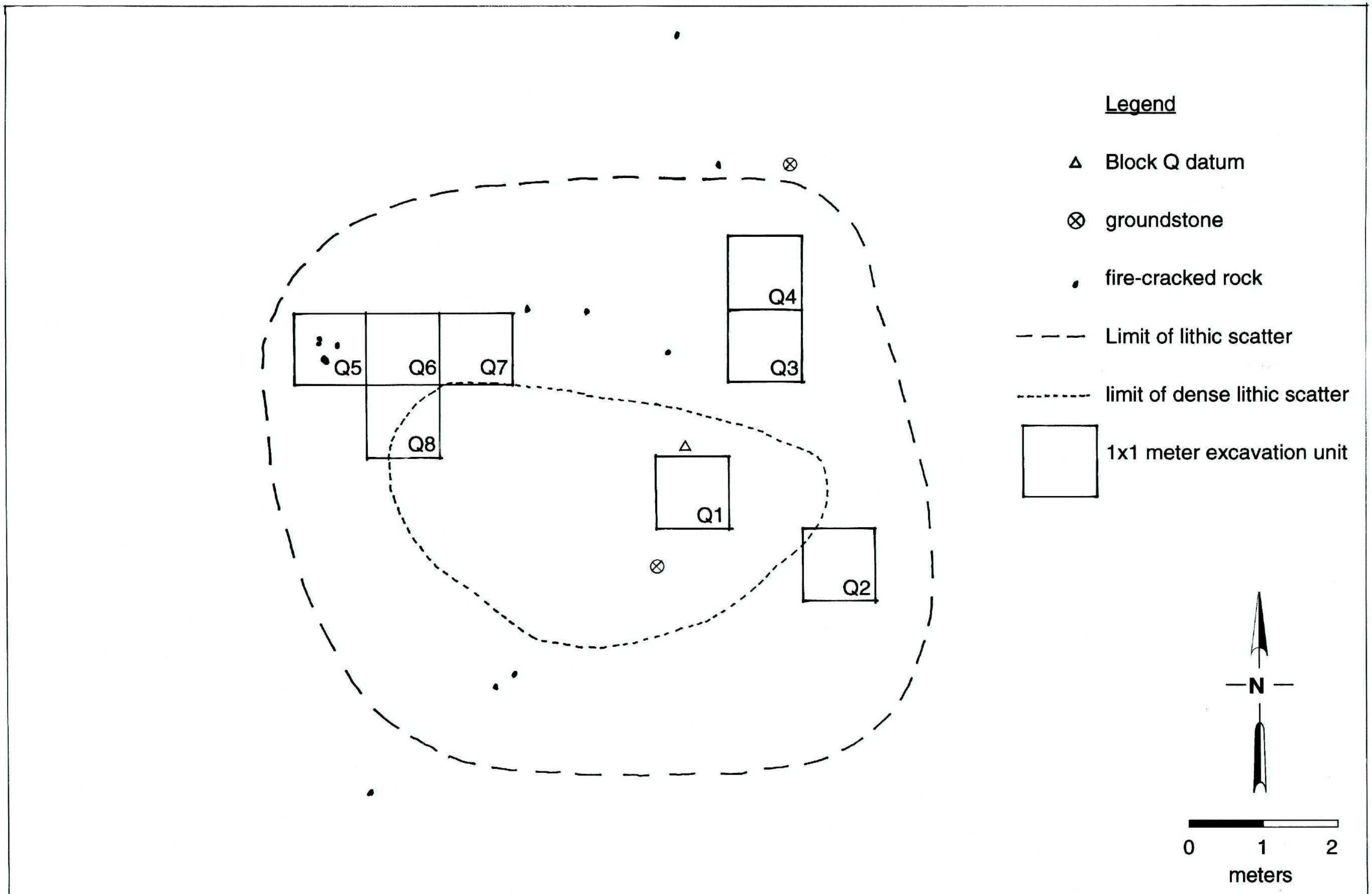

Figure 21. Plan view of Block Q with surface fire-cracked rock.

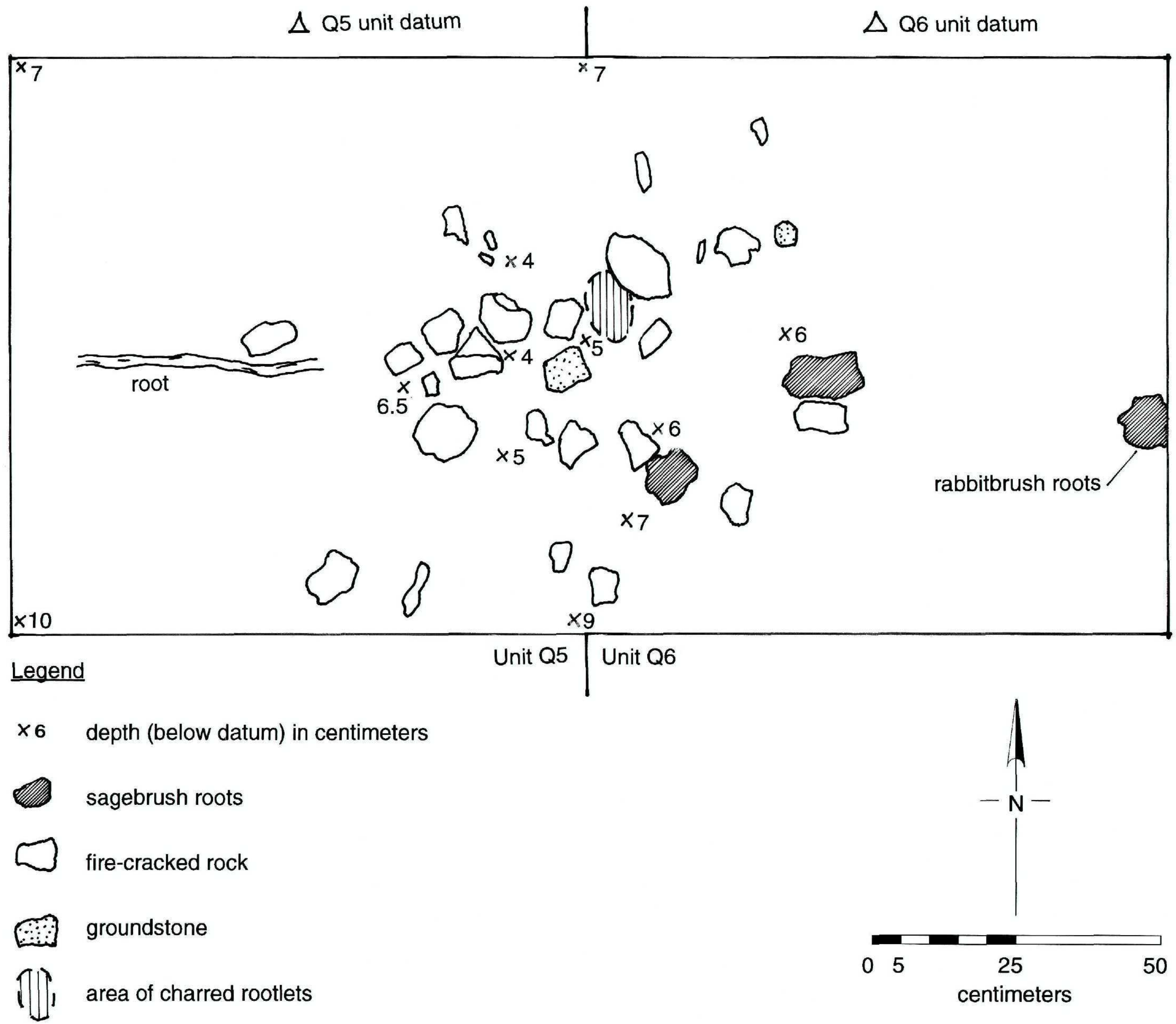

Figure 22. Plan view of Feature 33 (Units Q5 and Q6, after 4 cm surface scrape).

The lack of charcoal or ash and near-surface location in combination with the clustered arrangement of FCR suggests this feature has been eroded and may have once been a hearth. Any organic remains it may have contained have been leached from the fill; no feature outline was visible even in profile. Flotation of a sample of hearth fill returned only scanty sagebrush charcoal. An unidentified seed and a piece of grass stem tissue were also recovered (see Appendix G). Nonetheless, this area of the site seems to have been the focus of much activity. Projectile points, groundstone fragments, and other tools are common, and debitage is varied and numerous. A hearth in the midst of all this activity certainly would not be surprising.

Feature 34 (Unit AM1, 2)

This small charcoal stain was discovered in the north wall of Trench B during profiling. It consisted of a small, elongate, saucer-shaped lens of dark earth; further study discovered two strata within this burned layer. Excavation revealed that the feature extended from 15-34 cm below surface and consisted of two lenses of a dark gray-brown platy silt loam separated by a 2 cm thick layer of reddish brown burned earth. The fill had been mixed in places by insect or rodent disturbance. The deepest part of the feature appears to have been removed during excavation of the trench and only a small part was preserved in Unit AM2. Only the first platy fill layer and the layer of burned earth are visible in the unit's north wall profile (Figure 23); both dip steadily down toward the east-southeast. Though a flotation sample was taken from each fill layer, charcoal was scarce; a composite sample from all three layers returned a radiocarbon date of 850±200 B.P. (Beta-74722). The late date for this feature was unexpected because obsidian hydration data and projectile point typing have suggested primary occupation of the site occurred during the Middle Archaic (see discussion below and in Chapter 6). This hearth date and several narrow obsidian hydration measurements does suggest, however, that the site was used (if only occasionally) in the Late Archaic as well. Further evidence for a cultural surface at the level of this feature is found in the debitage samples from this unit (Table 6). There is a sudden abrupt decrease in heat-treated debitage and increase in colored debitage in samples from the feature's level of origin. As well, flake technology shifts abruptly from dominance by early stage debitage to an emphasis on the middle reduction sequence.

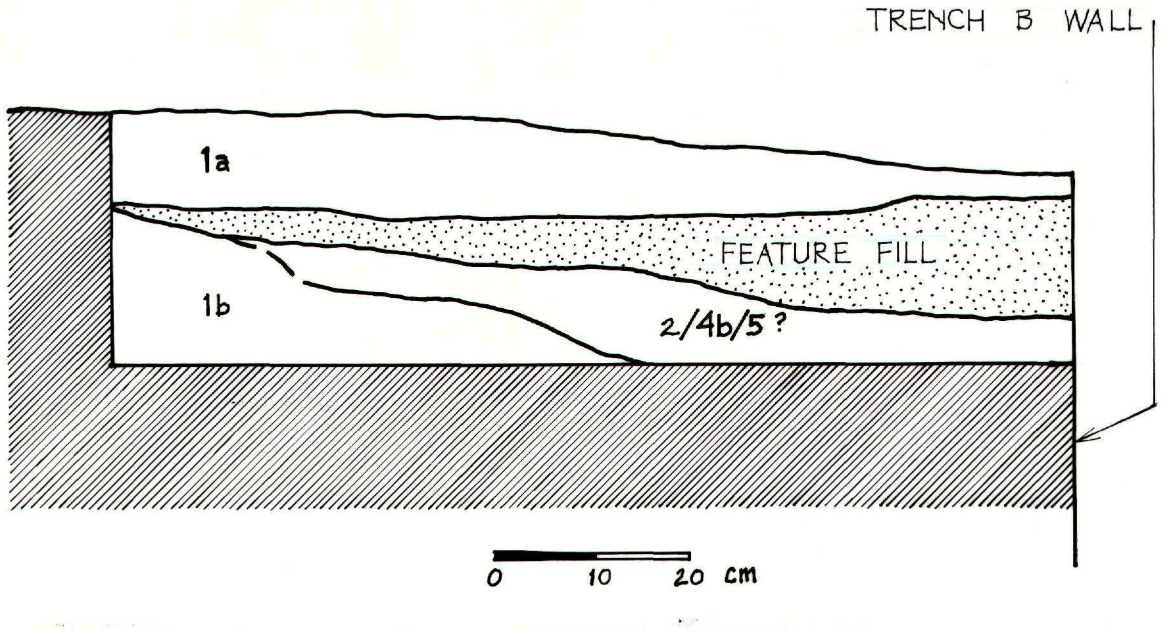

Figure 23. Profile of Feature 34 (Block AM) east wall of AM1.

Table 6. Debitage Samples from Excavation Units, by Level.

Unit/Level	% Heat treatment	% Color	Technological Characterization†	Size Grade--% of Sample G0	G1	G2	G3	G4	Comments
Northern Group									
J3-1 (F. 1)	60	20.6	bl	0	0	47	46.5	6.5	Obsidian--0.58%
J3-2	85	0	L*	0	0	67.7	32.2	0	
J3-3	75	18.9	L*r	0	0	22.6	74.2	3.2	
J3-4	75	22	L	0	0	45.5	53.2	1.3	
J3-5	70	2.5	beL	0	0	69.2	30.8	0	
N3-1 (F. 8)	85	45	cBEL*r	0	17.8	52.3	28.1	1.8	
N3-2	85	6.6	BeL	0	15	57.4	25.8	1.7	Obsidian--0.09%
N3-3	85	8.6	cbEL*r	0	22	46.5	30.2	1.3	
N3-4	90	4.4	b	0	22.8	38.1	34.8	2.6	
N3-5	65	12.4	belr	0	0	48	48.7	3.2	
N3-6	50	10.5	LR	0	0	69.6	30.4	0	Potlidded flakes
AE2-1 (F. 31)	50	0.9	bE*lr	4.4	38.2	42.5	14.5	0.4	
AE2-2	40	0.2	bE*lr	0	29.2	39.2	30.9	0.6	
AE2-3	40	1	bE*LR	8	29.2	41.4	20.2	1.1	
AE2-4	60	0.5	bEL*R	0	15.5	60.1	22.8	1.5	
AE2-5	55	42.3	E	0	0	31.1	68.9	0	
AE2-6	75	10	L*r	0	0	0	100	0	
Central Group									
P1-1 (F. 10)	80	16.9	cBElr	0	8.7	38.5	51.5	1.2	
P1-2	65	18.9	CbELr	0	18	45.8	35.4	0.8	
P1-3	85	23.1	cBEL*r	0	9	49.8	40	1.2	Obsidian--0.1%; burned, potlidded flakes
P1-4	60	15.6	cBEL*R	0	37.7	31.8	29.5	0.9	Obsidian--0.26%
P1-5	60	41.3	BEL*r	0	41.9	31.7	25.6	0.8	Obsidian--0.09%
P1-6	50	65.4	beL*r	0	0	48.1	47.7	4.1	
Q5-1 (F. 11)	60	31.7	cBELr	0	0	58.3	39.4	2.2	Obsidian--0.31%
Q5-2	80	14.7	cbELr	0	0	57.8	40.2	1.9	Obsidian--0.39%
Q5-3	70	39	CBE*LR	0	29.7	42.7	27	0.5	Obsidian--0.02%
Q5-4	70	18.4	cBELR	0	17.6	44.9	36.5	0.9	
Q5-5	70	21	CBELr	30.5	24	18.7	26	0.8	Obsidian--0.23%
Q5-6	60	23.2	cBeLr	0	11.2	35.7	50.1	3	Obsidian--0.56%

Table 6, continued.

Unit/Level	% Heat treatment	% Color	Technological Characterization†	Size Grade--% of Sample					Comments
				G0	G1	G2	G3	G4	
Central Group, continued.									
Q6-1	75	24.4	bElr	0	4.3	45.9	47.4	2.3	Obsidian--0.26%
Q6-2	55	44.3	CbElr	0	7.1	52.8	37.8	2.1	Heat-failed pieces
Q6-3	70	26.9	cBEL*R	0	12.9	41.2	45	0.9	Obsidian--0.17%
Q6-4	75	25.6	CBeLR	0	12.1	45.4	41.3	1.1	Obsidian--0.04%; Potlidded flakes
Q6-5	55	33.5	CBELr	0	34	36.3	28.5	1.1	Obsidian--0.06%
Q6-6	65	35.6	bELr	0	7.8	39	50.3	2.8	Obsidian--0.49%
Q7-1	65	37.2	bELr	0	0	49.1	47.9	2.9	
Q7-2	75	29.9	cBEL*r	0	11.9	38.6	46.5	3	Obsidian--0.44%; Burned
Q7-3	60	29	cbeL*r	0	15.8	38.7	44	1.4	
Q7-4	80	25.3	cBeLR	22.7	6.3	34.7	34.3	2	Obsidian--0.06%; Basalt--0.13%
Q7-5	70	23.3	cBEL*R	0	25.1	35	37.3	2.5	Obsidian--0.15%; Basalt--6%
Q8-1	65	35.3	B*ELR	0	16	37	45.4	1.6	Obsidian--0.15%
Q8-2	65	33.1	bELr	0	13.2	41.5	44.1	1.1	Obsidian--0.08%
Q8-3	80	24.3	cBEL*r	0	7	45.9	46	1.1	Obsidian--0.10%
Q8-4	70	12.2	cBE*LR	16.3	32.8	30	20.4	0.4	Obsidian--0.02%
Q8-5	80	25.9	cbeLR	0	16.7	41.4	40	2	Obsidian--0.15%; Heat-failed pieces
R2-1 (F. 13)	75	43	cbELr	14.9	7.4	35.3	40.4	2.1	Some burning
R2-2	65	37	bElr	0	0	42.6	48.9	8.5	
R2-3	80	16.5	cbElr	0	0	54.8	40.6	4.6	Some burning
R2-4	80	22	cElr	0	0	26.8	66.1	7.05	Basalt--4.7%; Some burning
T2-1 (F. 15)	65	4.6	cbELr	0	13.2	54.5	31.6	0.6	
T2-2	75	3.4	cElr	0	19	45	35.3	0.7	
T2-3	65	8.2	cbELr	0	19.9	47.2	31.7	1	Some burning
T2-4	80	6.2	cbE*Lr	0	16.4	51.7	31.1	0.8	A few burned pieces
T2-5	65	18.3	cbElr	0	43.4	29.2	25.8	1.5	Obsidian--0.67%; Some burned flakes
V2-1 (F. 17)	60	16.4	cbElr	0	18.8	47.4	37.6	1.1	Obsidian--0.05%
V2-2	70	6.5	cbElr	0	42.6	32.2	24.2	1	
V2-3	25	25	bElr	0	51.8	26.1	20.7	1.3	
V2-4	50	19.6	bELr	0	31.1	33.8	32.5	2.6	

Table 6, continued.

Unit/Level	% Heat treatment	% Color	Technological Characterization†	Size Grade--% of Sample					Comments
				G0	G1	G2	G3	G4	
Central Group, continued.									
AF1-1 (F. 32)	95	2.8	EL	0	0	78.8	20.3	0.8	
AF1-2	100	4.2	EL*	0	46.9	26.9	26.2	0	
AF1-3	90	16	EL*	0	0	66.3	33.2	0.5	
AF1-4	75	8.8	L	0	0	22	78	0	
AG1-1	70	17.8	bel	0	0	44.9	53.4	1.7	
AG1-2	70	24.8	BeLR	0	0	39.3	58	2.7	
AG1-3	80	13.1	bEL*R	0	9	46.2	43.3	1.4	Basalt--0.08%
AG1-4	60	12.9	bE*Lr	0	11	43.7	43.8	1.4	Obsidian--0.15%; Basalt--0.15%
AG1-5	65	33.5	bE*LR	0	10.8	56.9	31.2	1.1	Basalt--0.06%
AG1-6	65	22.1	ELr	0	0	23.5	73.7	2.8	
AG1-7	80	4.2	bE*Lr	0	27.4	31.6	38.8	7.2	
AG1-8	50	9.6	R	0	0	41.1	59	0	
AI1-1	100	16.9		0	0	60	40	0	
AI1-2	95	0	bL*	0	0	44.8	54.2	1	
AI1-3	80	6.7	beL*	0	41.1	28	28.8	2	
AI1-4	95	13.1	L*	0	0	73.8	26.1	0	
AI1-5	75	13.6	bl	0	0	65.8	34.2	0	
AM1-1	85	21.3	cBELr	0	8.2	50.7	39.2	1.9	Burning
AM1-2	40	75	bel	0	0	70.4	25.3	4.3	
AM1-3	60	17.4	cBELR	0	23.3	36	38	2.8	
AM1-4	60	33.3	CBE	0	5.9	56.5	36.2	1.4	Obsidian--0.16%; Potlidding
AN1-1 (F. 12)	85	13.2	BE*LR	0	21.3	38.7	37.6	2.3	Obsidian--0.05%; 1 bipolar flake
AN1-2	75	4.4	BE*Lr	0	43.6	42	14.3	0.6	
AN1-3	75	4.6	cBEL*r	10.5	19.9	42.9	25.3	1.4	Obsidian--0.01%; Basalt--0.01%
AN1-4	75	17.1	cBELr	0	45.2	30.2	23.7	0.8	Obsidian--0.11%
Southern Group									
S2-1 (F. 14)	65	4.6	cbElr	0	10.3	55.3	33.6	0.7	
S2-2	70	7.6	cbElr	0	9.7	54.2	35.5	0.6	
S2-3	75	5.9	bElr	0	17.8	33.6	47	1.6	

Table 6, continued.

Unit/Level	% Heat treatment	% Color	Technological Characterization†	Size Grade--% of Sample G0	G1	G2	G3	G4	Comments
Southern Group, continued.									
S2-4	65	6.6	cbElr	0	53.1	32.5	14.1	0.3	Potlidding and burning
S2-5	50	19.5	Elr	0	46	29.3	24.7	0	Obsidian--1.05%; Potlidding and burning
S2-6	80	9.4	cbEL	0	0	58.4	40.2	1.3	Basalt--12.9%
X1-1 (F. 22)	65	7.2	CBE*L	0	26.3	40.8	32.1	0.8	
X1-2	50	4.4	EL	0	0	42.6	57.4	0	
X1-3	80	19.6	beL*R	0	19.1	38.9	40.3	1.7	Some burning
X1-4	60	6	BEL	0	0	0	98.2	1.8	
Y1-1 (F. 25)	75	11.7	B*Elr	0	14.1	54.4	30.4	1.1	Obsidian--0.18%
Y1-2	80	17.6	bE*L	0	16.6	50.6	31.3	1.4	
Y1-3	75	11.6	cBELr	0	8.6	52.4	38.1	0.9	Obsidian--0.28%
Y1-4	70	30.5	bE*lr	0	0	54.8	43.3	1.9	Obsidian--0.09%
Y1-5	60	11.3	cbeL*r	0	0	55.1	41.5	3.4	
Y1-6	80	32	bElr	0	0	50.8	47.3	1.7	
AH2-1	65	28.9	BEL	0	0	54.7	45.3	0	
AH2-2	85	41.9	eL*	0	0	61.8	38.2	0	Burned pieces
AH2-3	70	27.9	BE*l	0	0	77.2	22.8	0	
AH2-4	90	46.4	cB*el	0	25.8	41.8	31.8	0.5	
AH2-5	75	21.1	E	0	41.9	36.4	21.6	0	
AH2-6	40	27.4	BELr	0	17.3	60.3	21.7	0.6	Basalt--0.21%
AH2-7	50	34	BeL	0	0	37.5	62.5	0	Basalt--0.38%
AH2-8	50	53.1	bE*l	0	14.7	68.1	17.2	0	
AH2-9	75	41.9	bEL	0	30.7	59	10.2	0	
AH2-10	75	48.3	cbElr	0	0	44.7	55.2	0	
AJ1-1	65	28	bEl	0	0	43.5	56.5	0	
AJ1-2	95	40.7	beL	0	0	76.3	23.6	0	
AJ1-3	65	15.9	bEL*r	0	17.9	40.3	40.2	1.5	
AJ1-4	85	10.5	eL*	0	0	51.2	48.8	0	Obsidian--0.19%
AJ1-5	85	17	cbeL*r	0	0	43.2	55.7	1.1	Obsidian--0.17%; Potlidding
AJ1-6	90	31.9	bE*L	0	37.5	41.5	20	1	
AJ1-7	75	60.2	Bl	0	0	70.2	29.8	0	Potlidded flakes

Table 6, continued.

Unit/Level	% Heat treatment	% Color	Technological Characterization†	Size Grade--% of Sample G0	G1	G2	G3	G4	Comments
Southern Group, continued.									
AL1-1	70	44.6	belr	0	30	29.3	38.5	2.1	
AL1-2	75	20.7	eL*r	0	27.2	34.7	35.5	2.6	
AL1-3	65	23.3	EL*r	0	19.8	41.6	37.4	1.2	
AL1-4	65	26.8	cbEL*R	0	20.7	39.1	39.4	0.7	
AL1-5	70	24.5	cBElr	0	45.6	34.8	19.1	0.4	
AL1-6	75	26.5	BeL*r	0	27.9	38.6	32.3	1.1	
AL1-7	65	23.1	cbeL*r	0	10.4	52.8	35.6	1.2	
AL1-8	60	15.7	BeL*r	0	10.6	56.6	32.1	0.7	Obsidian--0.06%
Other									
AK1-1	85	9.5	be	0	83.6	0	16.3	0	
AK1-2	85	9.1	ELr	0	0	52.6	46	1.4	
AK1-3	95	6.3	bE*LR	0	26.3	37.3	35	1.3	

† c=core reduction, b=blank preparation, e=early thinning, l=late thinning, r=retouch.
Small case--minor component, Capital letter--common component, Emphasized capital--Dominant

Five soil samples were collected from the feature, three from Level 3 of Unit AM1 and two from a column sample (labeled Unit AM2) of feature fill taken from the east wall of Unit AM1. Charcoal content was extremely low in all samples (these samples were picked through for radiocarbon assay before macrofossil analysis) although sagebrush and a hardwood were present. Rootlets and insect burrows were common throughout suggesting that bioturbation has been extreme. Twelve charred seeds were recovered, including goosefoot or chenopod (*Chenopodium* sp.), plantago (*Plantago* sp.), chickweed (*Stellaria* sp.), a bunchgrass seed, two unidentified grass seeds, and a tiny legume seed. Seed quantities are too low for interpretation as food remains. Plant tissue noted included grass stems, lily bulbs, and unidentified fragments (cf. Appendix G).

Feature 39 (Unit AN1)

Testing in 1992 excavated a unit in Feature 12, a dense, discrete, surface opalite reduction scatter covering a 6 m^2 area. Upon our return in 1994, we found this backfilled unit had been partially eroded along its north wall and that a small charcoal stain (Feature 39) was visible in the northwest corner. In addition, flake densities in the eroded area were extremely high, suggesting that surrounding untested deposits were rich. Therefore, a second unit was excavated off the north wall of the 1992 unit, designated Unit AN1.

Feature 39 was not encountered until the base of the surface scrape (4 cm below surface) and continued until 20 cm below surface. The fill consisted of a dark platy silt loam with charcoal flecks and numerous small thinning flakes. Feature fill was collected in two bulk samples. Though many small charcoal flecks were visible in these samples, dry sorting and flotation recovered insufficient charcoal for radiocarbon dating. Only an ephemeral boundary was visible in the unit wall after excavation. Once again, charcoal content was low in the soil sample analyzed for macrofossil identification; dark staining may thus have been due to modern organic content. Grass stems, sage twigs, and a grass seed were noted. Counts of small opalite flakes were particularly high.

Two interesting items were associated with Feature 39. First was a burned, charcoal stained area in the east half of the unit which extended from 4-6 cm below surface and encompassed Feature 39 in the southeast. This stain was mottled, soft in spots, perhaps badly mixed. Second, the level below the feature (Level 3) was extremely artifact rich, particularly in the south half of the unit, exhibiting clast-supported lenses of flakes and biface fragments. Feature fill at this level was also full of small thinning flakes. A large part of the concentration of materials in this area may be the result of erosion of the test unit with materials washed in and concentrating in this low spot. It is also possible that Feature 39 may have been excavated into this rich layer of artifacts.

Features 35-38, 40, 41

Numerous charcoal stains were exposed by mechanical scraping of the ground surface in non-feature contexts. The majority of these could be discounted by only cursory inspection as recent root burns. Six, however, were anomalous enough to require excavation. Units of 1 m x 50 cm bisected these features. In these units, half the feature was excavated and if it proved to be natural, excavation was terminated. Features 35, 36, 37, and 38 were excavated in this manner and abandoned; a biface fragment was collected from the surface of Feature 35. No unit materials were screened nor samples or artifacts collected.

Features 40 and 41, however, were more anomalous and were excavated like standard excavation units in one 10 cm level from an established datum. Feature 40 consisted of a 30 x 20 cm mottled smear of black, red-brown burned, and dark brown earth which continued for approximately 10 cm in depth. Feature fill looked disturbed or badly turbated and small patches of mottled feature fill were encountered sporadically throughout the unit level. Feature fill was collected as a bulk sample; though dry sorted and subsequently processed by flotation, only rare charcoal flecks were recovered. Throughout excavation the feature boundary was ephemeral and no outline was visible in profile. No fire-cracked rocks were noted though some flakes looked burned. If this was a cultural feature such as a hearth, it appears to have received no formal preparation (such as pit excavation or a rock lining before use), and subsequently to have been severely turbated. It is possible this is a modern burn feature, though the lack of charcoal in such an instance is unusual. Botanical remains encountered in flotation residue consisted mainly of sagebrush. Herbaceous stem and grass tissue were also noted (cf. Appendix G).

A full 10 cm level was excavated in Feature 41. Feature fill was collected as a bulk sample; the remaining level spoil was screened and artifacts collected (30+ flakes). The feature consisted of a roughly circular dark stain averaging 50 cm in diameter with a platy dark silty loam fill interspersed with clay in insect and rodent burrows. Signs of mixing and bioturbation were common as were sagebrush roots. Particularly intriguing was the mixture of what appeared to be "fresh" and more weathered charcoals. Despite the abundance of charcoal flecks, sufficient carbon could not be recovered for either standard or extended count radiocarbon dating though the bulk sample was collected from the bottom of the feature (7-10 cm below surface) where it appeared less disturbed. Carbon content of this feature was low and no seeds were noted. Grass and herbaceous stem and root tissues were present (cf. Appendix G). Despite heavy disturbance it appears that Feature 41 consisted of a zone of heavy mixing and turbation above a small charcoal stain associated with a second, apparently recent, charcoal stain. The degree of disturbance in this area precludes specific interpretation of this feature.

Cultural Stratigraphy

Excavation was continued below the first level in 13 features (1, 8, 10, 11, 12, 13, 14, 15, 17, 22, 25, 31, 32); an additional seven discretionary units (Units AG1, AH1, AI1, AJ1, AK1, AL1, AM1) were excavated to test for cultural deposits and reveal stratigraphy in areas where no surface features were identified (cf. Figure 8). Table 6 summarizes debitage samples from each unit level—the categories are the same as those used in Table 4. Table 7 lists the number and type of tools recovered from each level. The following section begins with a brief discussion of variations down profile in each subsurface unit, correlated where possible to stratigraphic breaks. The record of these stratigraphic surfaces then is discussed in light of its implications for the character of site use through time.

Features chosen for subsurface excavation were selected by topographic location, surface feature composition, and potential to yield significant subsurface deposits. The following assessments of each unit utilize variation in debitage sample composition, tool content, and raw material to identify possible cultural surfaces.

Feature 1, Unit J3

This feature was located on the southeastern edge of Terrace 2 on the northern ridge. Excavation extended for five levels. Variations in debitage sample composition are most noticeable in Level 5, where colored debitage decreases and early stage debitage (blank reduction and early thinning flakes) occurs for the first time; late stage thinning flakes dominate the previous levels (cf. Table 6). A slight increase in heat-treated debitage was noted in Level 2, corresponding to a decrease in colored debitage in the same level. Finally, there is a peak in the percentage of G3 (1/4 in) debitage in Level 3 and in G2

Table 7. Artifact Tally for Excavation Units at 26Ek5040.

	BIFACE STAGES													
	Indeter.	Late 2	Early 3	Mid 3	Late 3	Early 4	Late 4	Early 5	Late 5	Flake Tool	Core/ Mod. Chunk	Preform	Projectile Pt.	Groundstone
North Group	0	0	0	0	0	0	0	0	0	0	0	0	0	1 hammerstone
J3-1 (F. 1)	1													
J3-2														
J3-4	1			1										
J3-5	1													
N3-1 (F. 8)	2				1			1		2				
N3-2	1			1										
N3-3	10			2	2			4		2				
N3-4	2					1								
N3-5	1													
N3-6														
AE2-1 (F. 31)	6			1										
AE2-2	2													
AE2-3	2		1	1						1				
AE2-4														
AE2-5														
AE2-6	1													
Central Group														
P1-1 (F. 10)	2									1				
P1-2			1											
P1-3					2						1	1		
P1-4		1			1	1				1			Obsidian tip fragment	1 metate
P1-5										2	1			
P1-6														
Q5-1 (F. 11)										4				
Q5-2														1 metate
Q5-3					3					1				1 metate
Q5-4				1						2				
Q5-5	1			2						1				
Q5-6	1									1			Opalite fragment	
Q6-1 (F. 11)		1			1			1		5			Opalite Out of Key	
Q6-2					1	1								1 metate

Table 7, continued.

	BIFACE STAGES									Flake	Core/			
	Indeter.	Late 2	Early 3	Mid 3	Late 3	Early 4	Late 4	Early 5	Late 5	Tool	Mod. Chunk	Preform	Projectile Pt.	Groundstone
Central Group, continued.														
Q6-3	1			1	2		1	1		3				
Q6-4				1				1		4			Opalite Elko, Exo. Crt Elko	3 metate
Q6-5				1							1			1 metate
Q6-6	1			1				1					Opalite fragment	1 metate
Q7-1 (F. 11)	1									2				
Q7-2				1						2				
Q7-3			1		2					1				1 mano
Q7-4				2						2			Opalite tip fragment	
Q7-5		1			1				1	2				
Q8-1 (F. 11)					1		1			5				
Q8-2							1							
Q8-3				1			1			2			Opalite fragment	
Q8-4							1			1				
Q8-5		1	1							2				
R2-1 (F. 13)	1							1		5	1			
R2-2														
R2-3										2				
R2-4	1				1					1				
T2-1 (F. 15)				1	1	1			1	1				1 hammerstone
T2-2														
T2-3	2								1					
T2-4	1			1			1			2			Obsidian fragment	
T2-5					1									
V2-1 (F. 17)	1		1											1 metate
V2-2														
V2-3	1			2	1		4			1				
V2-4														
AF1-1 (F. 32)														
AF1-2														
AF1-3	1			1										
AF1-4														

Table 7, continued.

	BIFACE STAGES									Flake	Core/			
	Indeter.	Late 2	Early 3	Mid 3	Late 3	Early 4	Late 4	Early 5	Late 5	Tool	Mod. Chunk	Preform	Projectile Pt.	Groundstone
Central Group, continued.														
AG1-1	2				1							1		
AG1-2	2									2				
AG1-3	1	1		1	1					1	1			
AG1-4	3	1								3				
AG1-5	1	1	1											
AG1-6										1				
AG1-7	2								1	1				
AG1-8														
AI1-1														
AI1-2														
AI1-3														
AI1-4	2			1										
AI1-5														
AM1-1										1				
AM1-2														
AM1-3										1			Opalite fragment	
AM1-4										1				
AN1-1 (F. 12)														
AN1-2	2			2						1				
AN1-3	2		1	2	1		1			1	3	1		
AN1-4										3	1			
Southern Group														
S2-1 (F. 14)				1										
S2-2					1									
S2-3														
S2-4				2		1								
S2-5													Obsidian Large side-notched	
S2-6														
X1-1 (F. 22)	2		1											
X1-2														
X1-3										1				
X1-4														

Table 7, continued.

	Indeter.	Late 2	Early 3	Mid 3	Late 3	Early 4	Late 4	Early 5	Late 5	Flake Tool	Core/ Mod. Chunk	Preform	Projectile Pt.	Groundstone
	BIFACE STAGES													
Southern Group, continued.														
Y1-1 (F. 25)	1		1	1	1	2				1				
Y1-2	1	1	1											
Y1-3				1			1							
Y1-4										1				
Y1-5														
Y1-6														
AH2-1				1										
AH2-2														
AH2-3														
AH2-4										1				
AH2-5														
AH2-6														
AH2-7										1				
AH2-8														
AH2-9														
AH2-10														
AJ1-1														
AJ1-2														
AJ1-3										2				
AJ1-4	2													
AJ1-5	2										1		Obsidian Elko	
AJ1-6														
AJ1-7	1													
AL1-1														
AL1-2										1				
AL1-3														
AL1-4														
AL1-5		1												
AL1-6										1				
AL1-7							1			1				
AL1-8			1							1				
Other														
AK1-1										2				
AK1-2				1						1				
AK1-3							1			3				

(1/2 in) debitage in Level 5. The sudden peak in G3 debitage in Level 3 occurs in Stratum 2a (Appendix H, Figure H.4a), which is the buried surface of the b2 paleosol described above. It has been dated to 4380±90 B.P. Tool counts also increase slightly below this contact (cf. Table 7). Level 5 at the base of the unit terminated in the B horizon of this soil; the concentration of larger debitage in this layer is most likely a result of geomorphic processes.

Feature 8, Unit N3

This feature is also located on Terrace 2 on the northern ridge. Excavation continued for six levels. Notable changes in debitage sample composition occur between Levels 4 and 5 (cf. Table 6) with a sudden decrease in the amount of heat-treatment; colored debitage in these levels increases relative to the rest of the unit record, exceeding 10%. There is a technological shift as well (cf. Table 6). Only blank reduction flakes are recorded in Level 4 though the sequence in the surrounding levels contains all flake types. Proportions of each debitage size grade also shift at this level. G1 (1 in) debitage drops out of the sequence after Level 4, while G3 (1/4 in) debitage increases from there. Worth noting is the large number of bifaces (18) recovered from Level 3 (Table 7). Two flake tools were also recovered from this level.

Level 3 of this unit encompasses a mixed zone between the first and second buried paleosols (cf.discussion above) (Appendix H, Figure H.4b) which may also contain a component of the modern soil. Variation in the debitage samples occurs below this zone in Stratum 2a, the buried surface of the second paleosol. Since changes in percentages of colored and heat-treated debitage should be independent of geomorphic sorting processes, the changes noted in Levels 4 and 5 most likely indicate a buried cultural surface.

Feature 10, Unit P1

Feature 10 is located on Terrace 3 on the crest of the southern interfluve. Six levels were excavated. The percentage of heat-treated debitage begins to decrease in Level 4 of this unit, contrasting with a marked increase in the amount of colored debitage in Level 5 (cf. Table 6). Core reduction debitage drops out of the technological sequence in Level 5. Tools were fairly common throughout this unit (cf. Table 7); counts increase slightly in Levels 3-5. Finally, there is an increase in G1 (1 in) debitage in Levels 4 and 5 (cf. Table 6) suggesting geomorphic "winnowing" on a stratigraphic surface. The stratum in which these changes occur is Stratum 2, the second buried soil (Appendix H, Figure H.4c). Level 5 is Stratum 4b, a mixed zone which is part of the third buried paleosol; cultural deposits from this level may represent the pre-Mazama record at this site.

Feature 11, Units Q5-Q8

This extensive feature was located on Terrace 3, the crest of the southern interfluve. Four units were excavated in a block with a single datum so that unit levels correspond. Units Q5 and Q6 continued for six levels, Q7 and Q8 for five.

In Unit Q5, percentages of colored debitage shift from level to level, high in Levels 1 and 3 and low in 2 and 4 (cf. Table 6). There is no change in flake types down the profile although changes occur in debitage size. Large G1 debitage is present only from Level 3 on and G0 is present only in Level 5. G3 debitage decreases in Levels 3-5 (where larger debitage increases), then peaks abruptly in Level 6. There is a marked increase in larger debitage in Levels 4 and 5.

In Unit Q6, an increase in colored debitage corresponds to a decrease in heat-treated debitage in Levels 5 and 6; conversely, in Unit Q7 there is an increase in heat-treated debitage in these levels. The percentage of heat-treated debitage in Unit Q8 increases in Level 3 along with a decrease in colored materials. As with Unit Q5, the technological sequence varies little in Q6, Q7, and Q8 aside from a lack of core reduction flakes in Level 1. In Units Q6, Q7, and Q8 there is an increase in large G0 (2 in) and G1 (1 in) debitage in Levels 4 and 5 (cf. Table 6) followed by an increase in G3 debitage in the following level in two units.

Flake tools were common in all units, the most coming from Level 1 and decreasing steadily down the profile (cf. Table 7). Elko series projectile points were recovered from Unit Q6, Level 4, and Q7, Level 1, and point fragments from all units. Bifaces were more common in lower levels (3-5) of Q5, Q6, and Q7, although stages were comparable.

Such variation in adjacent units suggests unit sediments have been disturbed. Obsidian hydration rind thicknesses from these units support this possibility. Obsidian flakes with rinds from 4.8 to 8.0 microns were recovered from Levels 4, 5, and 6 of Units Q5-Q8. However, obsidian from Unit Q7, Level 2 also measured 6.7 microns and from Unit Q8, Level 1, 4.8 microns. Such thick rinds in upper levels of these units suggests deposits are mixed.

The concentration of large debitage in Level 4 suggests size sorting by natural processes, although changes in debitage composition and tool quantities also indicate a possible cultural surface at this level. The strata are so mixed in this location that we cannot determine if a stratigraphic break is present and, if so, its correlation to the stratum in the master profile. Shifts in sample composition were noted in all units around Levels 4 and 5, suggesting that a once extant cultural surface has been destroyed by bioturbation and pedoturbation.

Feature 12, Unit AN1

This feature, just off the crest of the central ridge, was excavated adjacent 1992 test units. There is an enormous jump in quantity of debitage in Levels 3 and 4 of this unit, but no real change in the characteristics of the sample (cf. Table 6) aside from the introduction of core reduction debitage in Level 3. Tools are concentrated in Levels 3 and 4, including cores, preforms, flake tools, and bifaces (cf. Table 7). Amounts of large debitage are high throughout this unit with a noticeable decrease in Level 3 followed by a peak in Level 4. Samples from this unit are unusual in that they are dominated by G1 and G2 debitage rather than the G2 and G3 flakes of most units (cf. Table 6). The increase in tools and debitage in Level 3 occurs in Stratum 1b, on what is most likely the depositional break between 1a and 1b, and corresponding to the late Holocene soil surface (the first buried soil) dated to 850±20 B.P. (cf. above). The concentration of large debitage and tools such as bifaces and cores in these lower levels also suggests geomorphic size sorting on a depositional surface.

Feature 13, Unit R2

Feature 13 is located on the southwestern end of the southern ridge. Excavation continued through four levels. Only minimal change was noted in this unit (cf. Table 6). Heat-treated debitage increased in Levels 3 and 4, accompanied by decreased colored debitage. Technologically, there is minor variation in amounts of early stage debitage. In terms of size graded debitage, sample composition is most notably different between the sample from the surface and that from subsurface (Table 6). Debitage of all sizes appeared on the surface but only G2-G4 debitage appeared in the remainder of the unit. There is a noticeable spike in amounts of G3 debitage in the last level and amounts of G4 debitage are relatively high compared to other units on the site (cf. Table 6). Once again geomorphic sorting appears to be at work on a stratigraphic contact. The stratum in which these changes occur is the weathered zone with bedrock clasts which underlies the modern soil on the high points of Terrace 2 (Appendix H, Figure H.5b).

Feature 14, Unit S2

This feature was located on the far eastern end of the southern group. Unit S2 continued for six levels. There is essentially no change in debitage composition in this unit except for a small dip in the amount of heat-treated debitage, accompanied by a slight rise in colored debitage, in Level 5. Technologically, there are some minor changes, most notably in Level 5 where early stage debitage suddenly drops out of the sequence (cf. Table 6). A Large Side-notched obsidian point base also was recovered from Level 5. Large debitage is more common in Levels 4 and 5, possibly indicating a stratigraphic surface. Stratum 2 in this level has been identified as the B horizon of the second buried soil (Appendix H, Figure H.4c).

Feature 15, Unit T2

Feature 15 was located on the western edge of the southern ridge; the unit extended for five levels. Variations were minor, consisting of a slight increase in colored debitage in Level 5 and a slight increase in heat-treated debitage in Level 4 (cf. Table 6). Late thinning debitage increases slightly in Levels 3 and 4. Large debitage dominates the sample by Level 5. A wide range of biface stages was recovered from this unit, but there is no patterned variation in stage down the profile. As in Unit R2, the shifts in sample composition in Levels 4 and 5 occur in the contact zone between the mixed modern and late Holocene soils and the zone of weathered bedrock float above the Pleistocene paleosol (Appendix H, Figure H.6a).

Feature 17, Unit V2

Feature 17 is located in the center of the southern ridge. Unit V2 continued for four levels. The record from Unit V2 is marked by a decrease in the percentage of heat-treated debitage in Level 3, contrasted with a sharp rise in the amount of colored debitage in this level (cf. Table 6). Technologically, change is minor, including a loss of core reduction flakes in the last two levels and an increase in late thinning flakes in Level 4. Tool counts are high in Level 3 (cf. Table 7). Amounts of large G1 (1 in) flakes increase steadily down profile to Level 3 then drops off in the last level. Changes in color, heat-treatment, and tool counts along with the concentration of larger debitage in Level 3 suggest a stratigraphic break, once again falling in the mixed zone between Stratum 1/2 and the underlying Pleistocene soil (Appendix H, Figure H.6b).

Feature 22, Unit X1

This feature was located in the southern feature group; excavation continued for four levels. Changes noted include an increase in heat-treated and colored debitage in Level 3 and the sudden loss of early stage debitage in Level 2 (cf. Table 6). Blank preparation flakes return in Level 4. This alternation is reflected in debitage size grade as well where the mix of G1, G2, and G3 debitage in Levels 1-3 suddenly gives way to an almost pure sample of G3 debitage in Level 4 (cf. Table 6). This sorting is most likely natural inasmuch as it occurs on and just above the contact with the late

Pleistocene soil. Changes in color and heat treatment in Level 3, which should be independent of soil processes do, however, suggest a cultural surface at this level even though the stratigraphic record is mixed (Appendix H, Figure H.6c).

Feature 25, Unit Y1

Feature 25 is located in the southern group. Unit Y1 contained six excavation levels. While amounts of heat-treated debitage hold relatively steady throughout Unit Y1 (cf. Table 6), the percentage of colored debitage is more volatile, fluctuating from Levels 4 through 6. Technologically, the sequence is extremely mixed, shifting from level to level (cf. Table 6). Tool counts were high only in Level 1, dropping through the remainder of the profile. G1 debitage drops out of the sequence in Level 4. Level 4, Stratum 2 represents the buried surface of the second paleosol (b2) (Appendix H, Figure H.6d). The fluctuations noted in the remaining levels occurred in a mixed stratigraphic zone.

Feature 31, Unit AE2

Unit AE2, located on the far northern edge of the northern ridge, continued for six levels. Percentages of heat-treated debitage increase suddenly in Level 6 while percentages of colored debitage increase to a high of 42.3% in Level 5 (cf. Table 6) then decrease rapidly in Level 6. Technologically, there is little change until Level 5 where only early thinning flakes occur, and Level 6 where late thinning and retouch flakes are dominant. Tool counts are highest in Level 1 (cf. Table 7). Reflecting changes in technological composition, the smaller debitage size grades increase in Level 5 with the disappearance of larger debitage types. Level 5 (Stratum 2) marks the surface of the second buried paleosol; Level 6 falls in the B and C horizons of the same soil (Appendix H, Figure H.7a).

Feature 32, Unit AF1

Feature 32 is located on the far western edge of the site, an outlier of the central group. Excavation continued for four levels. Changes in the sequence include a modest decrease in heat-treated debitage in Level 4. Only thinning flakes were recovered throughout the unit. Two changes occur in the size grade proportions: G1 debitage occurs only in one level (Level 2), and there is a sudden rapid increase in G3 debitage in Level 4 to the exclusion of other size grades. Level 4 is composed of Stratum 1b sediments which constitute the B horizon of the first buried paleosol (dated to 850±200 B.P.) (Appendix H, Figure H.7b). Since changes occur only in debitage size in this level, natural rather than cultural processes may be responsible for the variation noted.

Unit AG1

This discretionary unit was excavated on the northern slope of the central ridge. Surface debitage here was sparse and no features were identified; surface tools also were less common in this area. Unit AG1 extended for eight levels. Proportions of colored debitage are variable, increasing in Level 2, decreasing through Levels 3 and 4, then increasing again in Level 5, with a sudden drop in Level 7. The technological sequence is highly variable (cf. Table 6). Tools are found throughout the unit (cf. Table 7). Proportions of each debitage size grade shift within this sequence. G1 (1 in) debitage appears only in Levels 3-5 and Level 7, G2 debitage, consistently common throughout, drops suddenly in Level 6 opposite a spike in G3 debitage. Overall, the composition of Level 6 and Level 8 samples are anomalous compared to the remainder of the unit.

The first soil changes occur in Level 2, Stratum 1b, the B horizon of the first buried paleosol. Level 5 consisted of Stratum 25 sediments, which is a mixed stratum of Mazama ash and silt (Appendix H, Figure H.7c). Levels 6 and 8 occur in a mixed zone between Stratum 25 and the underlying Pleistocene soil, which may contain a badly turbated B horizon for the third buried soil.

Unit AH2

This unit was located on the low terrace along the southern edge of the site. Excavation continued for 10 levels, encountering a 40 cm thick mixed bed of Mazama ash and silt between 30 and 70 cm below surface (Appendix H, Figure H.7d). Heat-treated debitage increased slightly in Levels 2 and 4, and again in Levels 9 and 10 (cf. Table 6); increases in colored debitage correspond to increases in heat treated debitage in Levels 2 and 4. Increases were also noted in Levels 7 and 8, during a decline in heat treatment. Emphasis shifts from middle stage flake types in the first three levels to dominance by the early reduction sequence in Level 4 (cf. Table 6). In Level 10, the entire flake sequence is apparent although early thinning flakes are most common. Tools were rare throughout the unit (cf. Table 7). Larger G1 debitage did not appear until Level 4-6; G2 debitage begins to decrease in these levels. A peak in G3 debitage occurs in Level 10.

The most notable changes in this sequence occur in Levels 2, 4, and 10, and Levels 6-8 are highly variable. Level 2 (Stratum 1b) corresponds to the B horizon of the late Holocene buried soil (soil b1) dated to 850±200 B.P. Level 4 falls on the contact between Stratum 2 sediments, the second buried paleosol, and the mixed ash and silt layer of Stratum 25. Krotovina disturbance is particularly heavy in this zone. Levels 6-8 encompass the bulk of Stratum 25; the degree of fluctuation in all samples from this level is not surprising considering the enormous amount of bioturbation that has occurred in this zone. Level 10 of this unit is a badly mixed zone of weathered bedrock float and portions of other strata. Changes in this level of Unit AH2 most likely are the result of bioturbation.

Unit AI1

Like Unit AG1, Unit AI1 was placed to test deposits in an area of sparse surface remains on the northern slope of the central ridge. The unit continued for five levels. Percentages of colored debitage are the most variable element in this unit (cf. Table 6), decreasing to nothing in Level 2 then increasing in Levels 4 and 5. Late thinning dominates the technological sequence; some early thinning flakes are in Level 3 (cf. Table 6). Tools were found only in Level 4. Composition of the size graded debitage samples changes little down profile aside from the limited occurrence of G1 debitage in Level 3.

Changes described above for Level 4 suggest a cultural and stratigraphic surface may occur at this level in which Stratum 1b gives way to Stratum 2a, the surface of the second buried paleosol (Appendix H, Figure H.8a). The concentration of larger debitage in Level 3 most likely is the result of a change in depositional processes between the surface soil (Stratum 1a) and buried paleosol (Stratum 1b) in this level.

Unit AJ1

This unit was sited on the juncture between colluvial and alluvial sediments along the low terrace on the southern edge of the site (cf. Figure 10), in the hope of encountering deep cultural deposits. Excavation continued for seven levels. Heat-treated debitage fluctuate somewhat in the first levels, increasing in Level 2 but decreasing immediately in Level 3 (cf. Table 6). Changes in amounts of colored debitage echo those in heat-treatment, increasing in Level 2, decreasing in Level 3, and then increasing twofold in Levels 6 and 7. Technologically, the upper unit levels are dominated by thinning flakes (cf. Table 6); early stage flakes begin to appear in Level 5. No tools were recovered from this unit until Levels 4 and 5 (cf. Table 7). Size graded debitage is dominated by 1/2 in (G2) and 1/4 in (G3) sizes with 1 in (G1) debitage occurring only in Levels 3 and 6.

The pattern of changeability in this unit is not immediately apparent. Two zones of change are apparent, however, encompassing Levels 2 and 3, and Levels 4 and 5. The shift in Levels 2 and 3 corresponds to the change between Stratum 1a (modern soil) and Stratum 1b (the first buried paleosol) (Appendix H, Figure H.8b). Levels 4 and 5 encompass the transition from Stratum 2, the second buried paleosol, to Stratum 25, the mixed layer of silt and Mazama ash. Change within these levels is variable, precluding an interpretation which favors either geomorphic or cultural processes.

Unit AK1

This unit was placed toward the far southeastern end of the site on the central ridge where no features, units, or trenches had been excavated. Unit AK1 was very shallow, encountering the weathered Pleistocene paleosol in only three levels. Heat-treated debitage increased slightly on this contact in Level 3 (cf. Table 6). Bifacial tools were found only in the last two levels (cf. Table 7). The change in technological stages down profile from rare flake types in Level 1 to the entire sequence in Level 3 suggests winnowing of smaller materials down profile by natural processes. Debitage size grade data echoes this progression (cf. Table 6). Level 1 is dominated by G1 flakes which rapidly give way to G2 and G3 debitage in the last levels.

Unit AL1

Cultural deposits in this unit, on the low terrace on the southern edge of the site, continued for eight levels. Decreases in colored debitage occurred in Levels 2 and 8; there is also much fluctuation from level to level in debitage technology (cf. Table 6). Most abrupt is a shift to early stage flakes in Level 5. Thinning flakes dominant through the remaining levels as do G2 (1/2 in) and G3 (1/4 in) debitage. A sudden peak in G1 debitage in Level 5 echoes the increase in early stage flakes mentioned above. Tools occur only below this zone in Levels 5, 7, and 8 (cf. Table 7). The shift in colored debitage noted in Level 2 corresponds to Stratum 1b, the buried late Holocene soil. Level 5 corresponds to Stratum 25, and Level 8 to either Stratum 21 or Stratum 4.

Unit AM1

This unit was excavated on the northern wall of Trench B to expose a small burned feature (Feature 34) noted in the trench wall. The feature was exposed in Level 3, 15 cm below surface, and continued to 34 cm below surface, gradually pinching out to the east. Feature fill was excavated as a bulk sample for flotation; materials from this sample are excluded from Tables 5 and 6. Feature 34 excavation, appearance, and content are described above.

Notable changes in this unit sequence include a sharp decrease in the amount of heat-treated debitage in Level 2 mirrored by an increase in colored debitage. Technologically, Level 2 is anomalous for containing only middle stage flakes (cf. Table 6). This, however, is an extremely small sample from a partial level, which most likely explains much of its variation from the composition of the sample from levels above and below. Early stage flakes were most common in Level 4 at the base of the unit. It is rather unusual that no bifaces were recovered from this unit when flake tools were found throughout and an opalite point fragment was recovered from Level 3.

Feature 34 was excavated into the B horizon of the first buried soil and served as the source for the date on this soil of 850±200 B.P. Shifts noted in Level 4 signal a change in depositional mode from the late Holocene soil to a mixed zone beneath.

Occupational Surfaces

There is clear evidence for two distinct occupational surfaces at 26Ek5040, and there is tantalizing evidence of an occupation around or possibly even before the time of Mazama ashfall (6850 B.P.), but these strata have been badly mixed by bioturbation and pedogenic processes which prevents secure identification of surfaces. Evidence from a group of units (R2, T2, V2, X1, AK1) also reveals areas where the cultural sequence has been compressed into a mixed layer which has been concentrated by natural sorting into lag deposits of large flakes and tools on the contact with the Pleistocene soil which underlies all site deposits.

Data from comparison of the feature groups has suggested changes through time and space in raw material use, tool manufacture, and tool use/discard at 26Ek5040. Comparison of the record on the three buried soil surfaces also reveals such variation. Table 8 lists the unit levels that have significant changes associated with the buried surfaces of the late Holocene (850±200) post-Mazama (4380±90), and possible Pre-Mazama buried soils.

Table 8. Unit Levels Associated with Buried Soil Surfaces.

Late Holocene soil (ca. 4380±90 B.P.–850±200 B.P.)
Unit AN1, Level 3
Unit AF1, Level 4
Unit AG1, Level 2
Unit AH2, Level 2
Unit AL1, Level 2
Unit AM1, Level 3

Post-Mazama soil (ca. 4380±90 B.P.–6900 B.P.)
Unit J3, Level 3
Unit P1, Level 4
Unit AE2, Levels 5, 6
Unit N3, Levels 4, 5
Unit S2, Levels 4, 5
Unit Y1, Level 4
Unit AH2, Level 4
Unit AI1, Level 4

Possible Pre-Mazama soil (pre 6900 B.P.)
Unit P1, Level 5
Unit AG1, Levels 6-8
Unit AH2, Levels 6-8

The records of each of these surfaces are typical of those for the site as a whole. Percentages of heat-treated debitage fall in the moderate range (60-75%) for most unit levels and percentages of colored debitage in the low range (5-20%). Unit AH2, Level 2 in the late Holocene soil, and Units AE2, Level 5 and AH2, Level 4 in the post-Mazama soil, exhibit higher than average percentages of colored debitage. Heat treatment is also higher than average in Units AH2, Level 4 and AI1, Level 4 in the post-Mazama soil. Late thinning flakes are the most common reduction type on both surfaces, with other flake types present in varying amounts. Biface stages are more varied in the post-Mazama deposits, compared to the Late Holocene deposits, in which biface stages closely resemble the more standardized production focus of the Late-Archaic dominated areas of the Tosawihi Quarries (cf. Chapters 5, 6). Heat-treatment of bifaces is slightly higher in the post-Mazama deposits, as are the figures for debitage heat-treatment. There is also a slightly higher proportion of bifaces made of colored chert in the post-Mazama deposits compared to the Late Holocene deposits.

Relative quantities of other artifact types also vary slightly between the two deposits. Groundstone, flake tools, and cores and modified chunks are slightly more common in the Late Holocene unit levels, while projectile points and obsidian are slightly more common in the post-Mazama unit levels.

Despite these differences, the record suggests is that there has been a fair degree of continuity in the ways 26Ek5040 was used through time, and that activities were varied and widespread during both these occupations. Some spatial variability between occupational surfaces is recognized, however. The units which contain intact records from the late Holocene occupation of 26Ek5040 are all located on the southern ridge. The northern ridge either did not achieve the same level of use during this time as during other occupations, or the late Holocene record on this surface is not well preserved. Conversely, several units on the northern ridge contain post-Mazama deposits, as do those on the southern interfluve. These spatial differences are also reflected in the obsidian hydration readings from these areas of the site which are discussed later in the report (cf. Chapter 6).

Three units hint at a possible pre-Mazama component at 26Ek5040. These units exhibit shifts in artifact type and quantity in sediments below Stratum 25, the mixed Mazama ash and silt layer, but these deposits have been so badly mixed it is unclear if a cultural surface is represented. In these sediments, percentages of heat-treated debitage are slightly lower than average (50-60% range) and percentages of colored debitage higher (25-40% range). Unit AH2 also contained one of the few substantial basalt samples from this site. Debitage technology is dominated by early and late thinning in all units. The biface assemblage from these unit levels is very small (n=3) and thus difficult to compare to those from later deposits. Only one of the three bifaces recovered could be placed in the reduction staging scheme used in our analysis (cf. Chapter 2), it was a finished Stage 5 biface. One of the three bifaces was made of colored chert and the other two of white opalite. Other artifacts from these unit levels include four flake tools and one core. Though distributed across the southern interfluve, all these units share a position in areas where Holocene-age sediments are particularly thick (cf. Figure 19).

Conclusions

Four soil surfaces were identified in site sediments but only two of them (b1, b2) contain stratigraphically distinct cultural components. There is some suggestion of a third component as well, but the strata in this zone (4a, 4b, 21-25) are too confused to permit clear interpretation. Differences noted between the composition of features in the surface feature groups and in the subsurface components of some units, have shown that the record of site use has been fairly homogeneous in some aspects and changeable in others. The kinds of tools being produced and the forms of raw material of their production appear to have remained fairly constant through time. Reduction trajectories for these materials were different, however. Use of 26Ek5040 also seems to have varied spatially through time, with tools of different materials, types, and stages manufactured in different places on site.

White opalite was the dominant material throughout use of the site, colored cherts seem to have been more common during the post-Mazama occupation. Both materials appear to have been transformed into bifacial tools on the same reduction trajectories. Core reduction and, to a lesser extent, retouch flakes, are rare in non-feature settings. Background scatter at the site is composed primarily of thinning flakes. In a number of units, the relationship of heat-treatment and color was notable; when the percentage of one category increased, the other usually decreased. This could represent laboratory bias to the extent that heat-treatment is more difficult to distinguish on colored debitage.

Only a small proportion of the artifacts recovered from the site derived from these three dateable unit level groups. Tool samples are very small and comparisons, thus, superficial. Conclusions derived from analysis of obsidian hydration readings and projectile points discussed in Chapter 6 interpret the bulk of the site deposits contemporary with the Post-Mazama strata.

Analysis of the assemblage from 26Ek5040 has shed new light on two questions posed during testing. Fifteen of the 32 features identified by 1994 excavations were internally consistent in composition, suggesting that each represents one reduction episode and, concomitantly, that each is a cultural feature rather than a post-depositional phenomenon. The remaining 17 features seem a mix of natural and cultural aggregations of debitage and tools. Too, a near surface and surface Late Archaic component at 26Ek5040 has emerged. Data from testing had suggested the site was occupied exclusively during the Middle Archaic. The post-Mazama component (which probably contains multiple occupations which could not be precisely dated) certainly comprises the most substantial occupation at the site, but the Late Archaic and possibly pre-Mazama components add temporal dimension to the occupation.

Chapter 4

ARTIFACT ANALYSES

Kathryn Ataman and Margaret Bullock

With little obvious cultural stratigraphy and almost no organic preservation, flaked and ground stone artifacts and their distributions provide much of the available information about occupation of 26Ek5040. This chapter describes the flaked, percussion, and ground stone tool assemblages; the one following describes debitage and core assemblages, the technological analysis of debitage, and raw material and tool trajectories. Artifact distributions and activity delineation are covered in Chapter 6.

Flaked Stone Tools

Flaked stone tools from 26Ek5040 include bifaces, projectile points and preforms, and several types of flake tools. Each is discussed in turn, following a word about the raw materials from which flaked stone tools at 26Ek5040 were crafted.

Most artifacts from 26Ek5040 are made of local hydrothermally altered silicic material of various derivations and appearances (Table 9), but the bulk is white, grey, or beige opalitic chert. A nearby source of similar light-colored, high quality material is a quarry complex located 1 km north of the site (cf. Figure 7), most likely the main source of material at 26Ek5040. This nearby source (CrNV-12-11927) consists primarily of outcrop quarrying locations, although pits may be concealed beneath the quarrying debris blanketing the ridge on which the site is located (Dugas 1994). The source appears exhausted; any previously existing surface outcrops have been quarried away.

Table 9. Flaked Stone Tool Classes and Raw Material.

	Number of Items					
	Tosawihi Chert	Exotic Chert	Basalt	Obsidian	Other	Total
Bifaces	463	8		3		474
Flake Tools	165	3	5			173
Points and Preforms	27	5		7		39
Cores and Modified Chunks	20		1	1	1	23
Debitage	50628	2	22	168	12	50832
Total	51303	18	28	179	13	51541

Colored cherts, derived from hydrothermal alteration of paleosols developed in both volcanic tuff and basalt bedrock (cf. Chapter 3), comprise the bulk of the remaining material. This toolstone can be found at various localities in the Tosawihi Quarries. Color is controlled by minerals in the parent material and by circumstances of deposition. Much of the altered basalt is slightly softer and more brittle than the opalite derived from tuff paleosols, and it responds differently to heat-treatment. Tuff and basalt-derived opalites are similar in appearance and no consistent differences in flaking quality are apparent, therefore we consider these two local materials as one, referring to them as 'colored' chert or opalite. We take variability in proportions of colored opalite in tool and debitage assemblages as an indicator of intensity of use of sources other than the nearest sources described above (where these colored materials do not occur).

Other raw materials appearing in the assemblage are obsidian, basalt, and exotic chert; the latter two are rare and obsidian is nearly so. Basalt is assumed to be local because basalt is readily available in the area, but the source(s) of the exotic cherts is unknown. Exotic cherts differ from the local colored cherts in color and glassiness; local cherts are primarily brown, purple, and yellow and have a dull luster. Forty-nine of the 179 obsidian artifacts recovered were analyzed for age and source (Appendix A). Most of the analyzed samples derive from one of the nearest obsidian sources, Paradise Valley, although several other sources were utilized by the inhabitants of 26Ek5040, as will be discussed in Chapter 6.

Despite the preponderance of local material in the flaked stone tool assemblage, material preference selection for certain tool types is apparent. Analysis of tool classes by raw material using adjusted standardized residuals (Table 10) yielded a significant chi square value. The null hypothesis, that there is no significant difference in raw material selection among tool classes, is rejected (df=12, x^2=143.97, P=.001). Bifaces are made from Tosawihi chert more often than expected and less often from basalt, obsidian, or exotic chert; flake tools are made of basalt more often than expected, while points and preforms show more exotic chert and obsidian specimens than expected and fewer than expected Tosawihi chert specimens.

Table 10. Adjusted Standardized Residual Values for Raw Material and Tool Type Relationships.

	Bifaces	Flake Tools	Points and Preforms	Cores
Tosawihi Chert	4.38	0.12	-7.81	-1.88
Exotic Chert	-1.45	-5.3	4.57	-7.4
Basalt	-3.49	3.38	-0.59	1.86
Obsidian	-2.81	-1.9	8.52	1.1
Other	-1.42	-0.57	-0.24	5.47

Values >+/- 1.9 are considered significant

Biface Technology

Most formed artifacts in the 26Ek5040 collection are bifaces; 474 complete and fragmentary specimens were recovered during data recovery and 163 during testing. The latter are described in Ataman et al. (1992), not to be reiterated in this report except in discussions of distribution (cf. Chapter 6).

In addition to the bifaces made of local opalites, the assemblage contains eight bifaces of variously colored dark cherts exotic to the Tosawihi Quarries and three obsidian bifaces derived from Paradise Valley, from Pinto Peak (Washoe County) or the Double H Mountains (Humboldt County), and from the widespread Brown's Bench source area located 75 to 175 km northeast of the site. The raw material data summarized in Table 11 are used in spatial analyses in later discussions.

Table 11. Biface Raw Material and Color.

	Local Material		Exotic Material			
	Frequency	Percent	Frequency	Percent	Total	Total Percent
White	293	63.8	0	0	293	61.7
Beige	41	8.93	0	0	41	8.7
Yellow	23	5.01	0	0	23	4.9
Brown	8	1.74	4	26.7	12	2.5
Black	0	0	4	26.7	4	0.8
Grey	49	10.67	1	6.7	50	10.6
Purple	9	1.96	2	13.3	11	2.3
Blue	4	0.87	1	6.7	5	1.1
Pink	28	6.10	1	6.7	29	6.1
Red	3	0.65	1	6.7	4	0.9
Green	1	0.22	1	6.7	2	0.4
Total	459	100.00	15	100.0	474	100.0

Biface manufacturing attributes can be used to examine spatial or temporal differences in technology. Five technological features are considered here: blank form, reduction stage, sequence of reduction, thermal alteration, and manufacturing failure. Each is discussed below and the data applied to subsequent analyses of context.

Blank Form

We are interested in blank form because it reveals information about technological processes often obscured by subsequent reduction. At residential sites or campsites at some remove from raw material sources, most tools are found in finished or near finished state and early stages are absent; only at production sites do we find evidence of early stage reduction (Ataman and Bloomer 1992:648-649; Bloomer, Ataman, and Ingbar 1992:130-131).

Biface blanks may be flake blanks detached from a core or directly from the bedrock; they also may be derived from alluvial or colluvial cobbles or blocks extracted from surface or subsurface bedrock. Flake blanks produced from cores and from bedrock can be morphologically similar, as is the debitage produced in their reduction, although bedrock-detached flake blanks at Tosawihi more frequently exhibit straight profiles, wide platforms, and hinged terminations (Ataman 1992b:89).

Flake blanks in early stages of reduction can be recognized by characteristic features on the unworked portions of the ventral surface, including point and cone of percussion, compression rings, and curved profile. Other, less convincing, evidence for the use of flakes as biface blanks is the presence of large cores. However, large cores can be worked into small ones and cores can be worked directly into bifaces; therefore, absence of flake-based biface reduction cannot be inferred from absence of cores. Similarly, presence of cores offers only circumstantial evidence of blank form.

Use of quarried blocks for blanks is even more difficult to recognize from relict features on bifaces. Unless a considerable portion of the original blank remains unworked, use of block blanks can be presumed only by reference to a combination of conditions: absence of cores, absence of flake blank produced bifaces, and absence of characteristic flake blank indicators in the debitage (bulb removal flakes and alternate flakes or edge preparation flakes with original flake blank surfaces present). Based on observations at other quarry locations at Tosawihi (Ataman 1992b:89-91), block-based reduction was common, but decisions to use the technique may be based on characteristics of particular toolstone deposits. Use of quarried blocks for biface blanks is difficult to examine in non-quarry contexts.

Since there are no suitable bedrock sources immediately around the site, we assume that large, heavy blocks were not imported. Opalite cobbles are available, although not plentiful, in the drainages running along the east and west margins of the 26Ek5040. Here, flake blank bifaces are contrasted with cobble bifaces and with those of indeterminate origin.

Approximately 40% of the biface assemblage was made on flake blanks, less than 1% on cobbles (Table 12). The proportion of recognizable flake blanks decreases with stage, as more material is removed from the biface; thus it is likely that the true proportions of both flake and cobble blanks are somewhat greater than they appear.

Table 12. Biface Blank Form and Reduction Stage.

	Blank Type				
	Flake		Cobble	Indeterminate	Total
Stage	Frequency	Percent	Frequency	Frequency	Frequency
Early 2	2	100	0	0	2
Late 2	19	95	1	0	20
Early 3	29	56.86	0	22	51
Middle 3	46	48.94	2	46	94
Late 3	38	48.10	1	40	79
Early 4	10	40	0	15	25
Late 4	12	38.71	0	19	31
Early 5	4	18.18	0	18	22
Late 5	0	0	0	9	9
Indeterminate	26	18.44	0	115	141
Total	186	39.24	4	284	474

Compared to other Tosawihi assemblages (Ataman 1992b:Table 22), the amount of flake blank reduction in the biface assemblage at 26Ek5040 is slightly higher, while incidence of cobble blanks is about the same.

Reduction Stage

Our biface reduction stages are based on Callahan's scheme (1979) for biface manufacture. Variation in extent of reduction (flake scar patterning), cross-section, and width/thickness ratio all contribute to the determination of stage. The first stage consists of the unworked blank, the second stage refers to blank preparation and edge preparation, the third stage to primary thinning (Figure 24), the fourth stage to secondary thinning (Figure 25), and the final stage to shaping and finishing (Figure 26). In previous work at Tosawihi (Bloomer, Ataman, and Ingbar 1992), we subdivided some of these stages (Stages 2 and 4 into early and late, and Stage 3 into early, middle, and late) to gain more detail about the organization of biface production. We use the same scheme here, and subdivide Stage 5 into early and late as well.

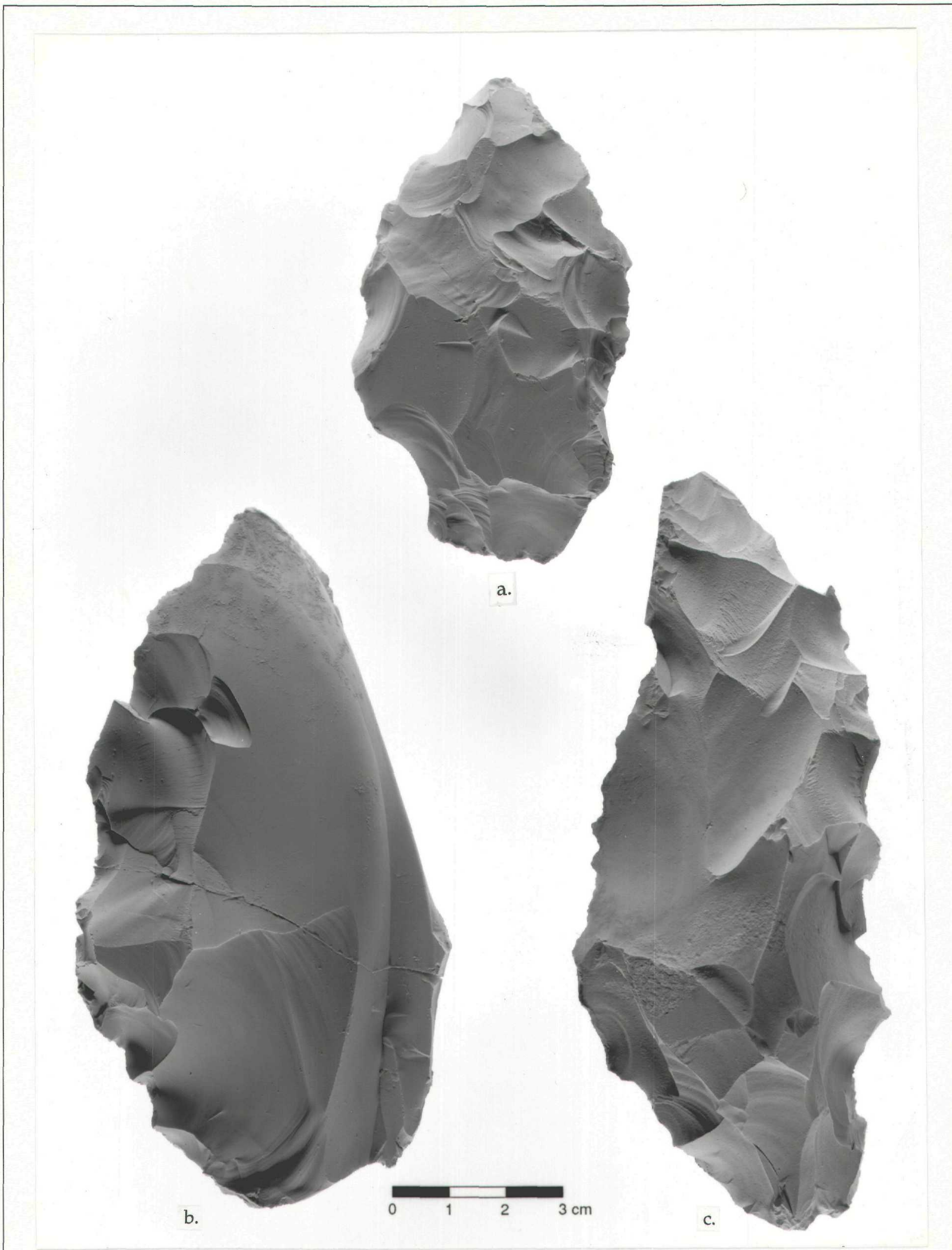

Figure 24. Selected Stage 3 bifaces.

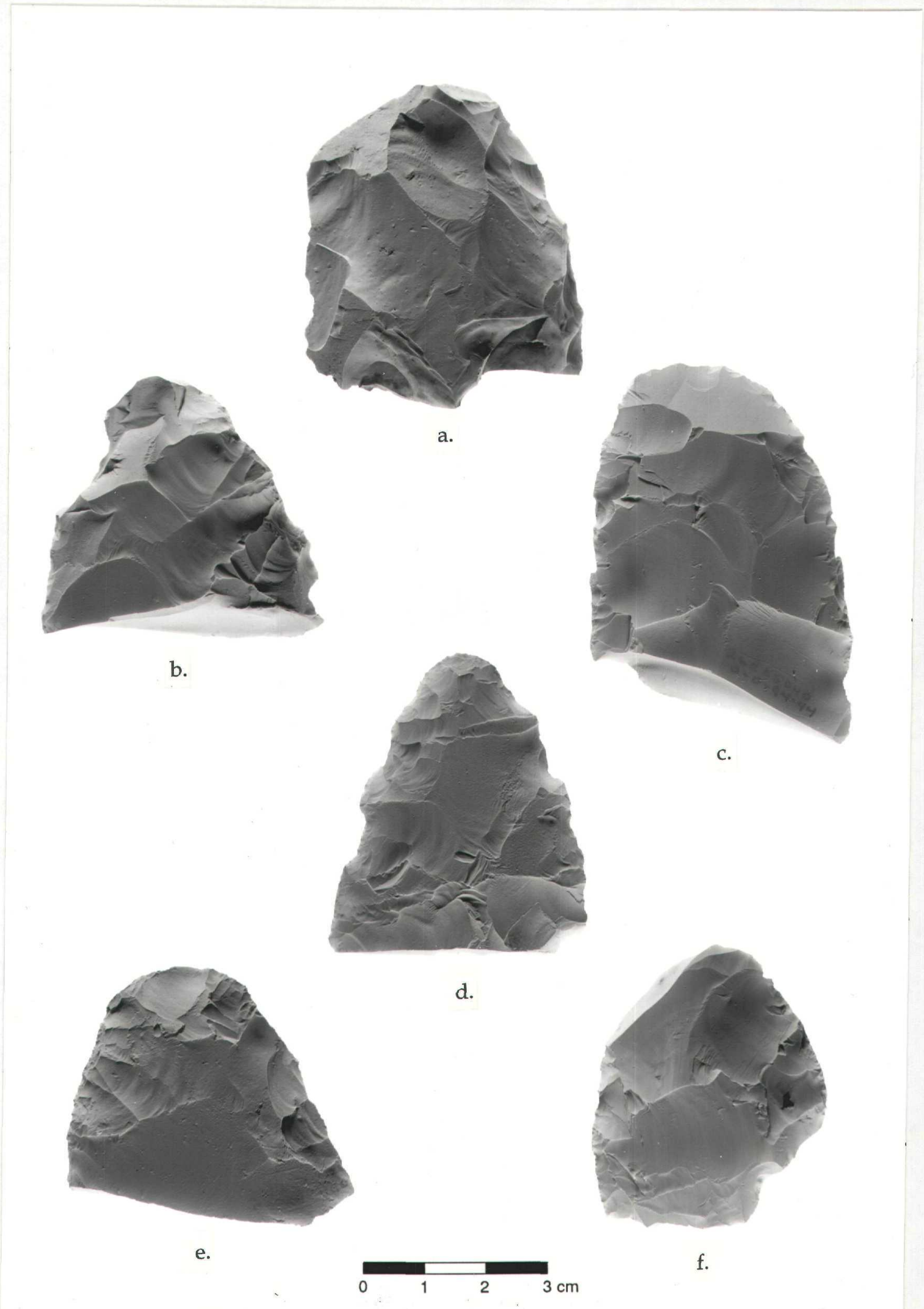

Figure 25. Selected Stage 4 bifaces.

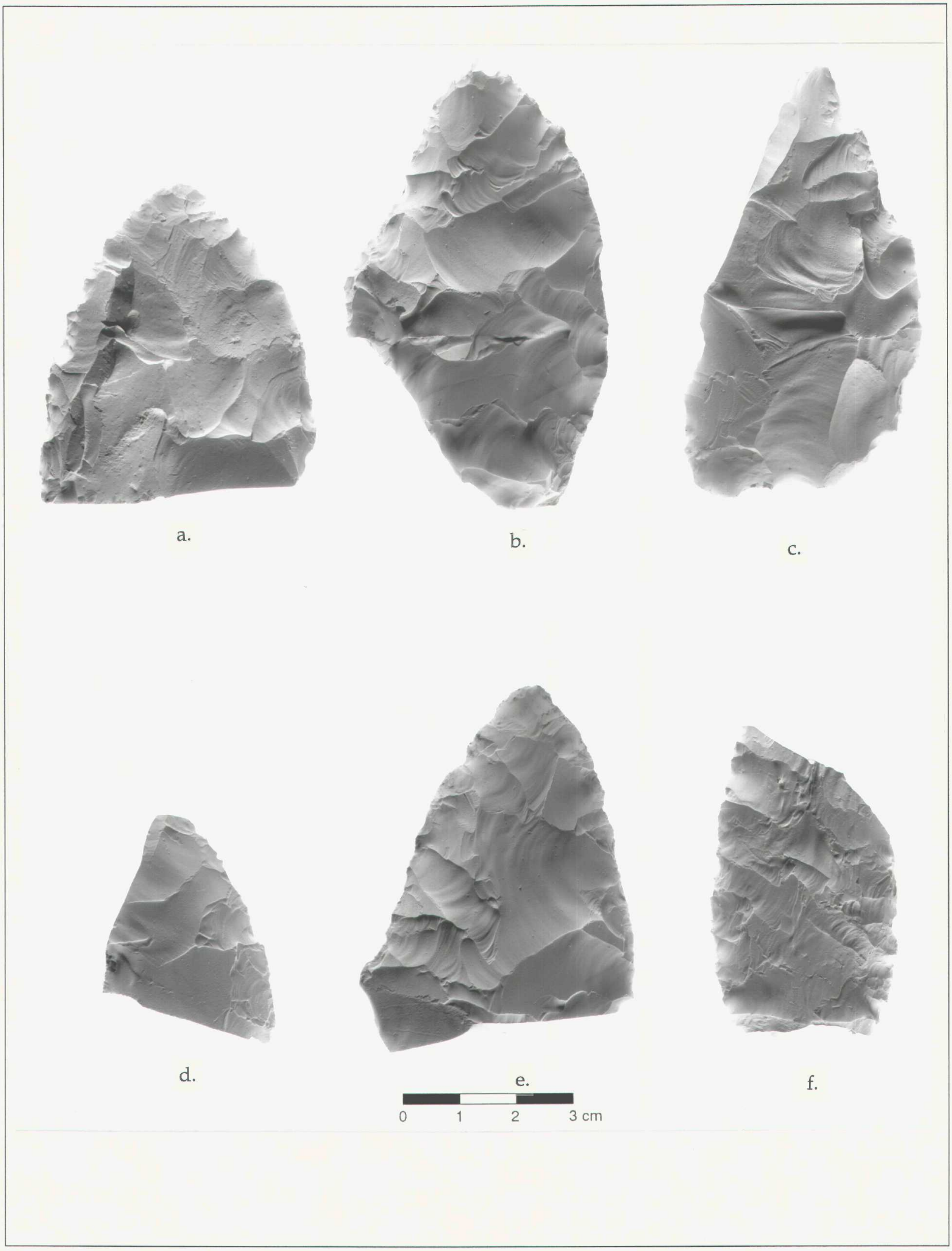

Figure 26. Selected Stage 5 bifaces.

The incidence of Stage 1 bifaces is usually very low because, as defined, a Stage 1 biface must have been selected for use in order to distinguish it from a rejected flake or block. In practice it often is not possible to recognize selected but unworked blanks, unless they are found in unusual contexts (e.g., a cache). At 26Ek5040, no artifacts were identified as Stage 1 bifaces.

As at most sites peripheral to the Tosawihi Quarries, the most common reduction stage represented in the 26Ek5040 biface assemblage is Middle Stage 3, halfway through primary thinning (Table 13). At this site, however, there is a greater range of stages represented, an indication that most of the biface thinning sequence, from Early Stage 3 to Late Stage 4, was undertaken here. Cores and core reduction debitage is rare and Stage 2 bifaces are infrequent, so it is likely that partially reduced bifaces, rather than chunks of unreduced raw material, were brought to the site for processing. The paucity of core reduction debitage (cf. below) supports this conclusion. The number of near finished late stage bifaces (Stages 4 and 5) is somewhat greater than at other Tosawihi sites (cf. Figure 50). The large proportion (30%) of indeterminate fragments is also indicative of later stage focus since heat-treatment, which often causes biface fragmentation (see below), is most common among later stage bifaces.

Table 13. Reduction Stages in the Biface Assemblage.

	Frequency	Proportion
Early Stage 2	2	0.42
Late Stage 2	20	4.25
Early Stage 3	51	10.83
Middle Stage 3	94	19.96
Late Stage 3	79	16.77
Early Stage 4	25	5.31
Late Stage 4	31	6.58
Early Stage 5	22	4.67
Late Stage 5	9	1.91
Indeterminate Stage	141	29.87
Total	474	100

Dorsal/Ventral Reduction

The extent of reduction on each face of the tool is an interesting representation of reduction sequence. The pattern of the sequence may be dependent on technological factors such as the shape of the blank. For instance, if the blank is thin at the start, there is less need for ventral thinning, which may be delayed until reduction on the dorsal face is more advanced. However, this technique can also reflect idiosyncratic rather than technological behavior, and thus indicate stylistic preferences of a particular group of people (Skinner 1990:243; Ataman 1992b:97). In order to examine differences in dorsal and ventral reduction, the reduction stage on each face (determined by flake scar patterning *on each face*) was considered separately.

At 26Ek5040, most (73%) bifaces are reduced equally on each face as reduction proceeds (Table 14). Among unequally reduced bifaces, the ventral surface in Stage 2 is sometimes reduced prior to the dorsal surface. Similarly, in Early and Middle Stage 3 *most* unequal reduction involves earlier dorsal than ventral reduction, and in Late Stage 3, Stage 4, and Early Stage 5 *all* are more extensively reduced on the dorsal than the ventral surface. In Late Stage 5, both surfaces usually are flaked entirely so that all Late Stage 5 bifaces appear equally finished. The unequal reduction is probably a function of both desired form and the use of flake blanks, because a flake blank usually has a fairly flat ventral surface and a convex dorsal surface. Thus, somewhat more effort is required to reduce the dorsal surface and produce a symmetrical cross-section.

Table 14. Differential Dorsal/Ventral Reduction on Bifaces.

Stage on Ventral Surface	Stage on Dorsal Face: Early Stage 2	Late Stage 2	Early Stage 3	Middle Stage 3	Late Stage 3	Early Stage 4	Late Stage 4	Early Stage 5	Late Stage 5	Indet.	Total
Stage 1			2		1		1				4
Early Stage 2	**2**			2	1						5
Late Stage 2	1	**19**	11	18	8	1	2	1		3	64
Early Stage 3		2	**25**	3	4			1		1	36
Middle Stage 3	1		1	**59**	8		1				70
Late Stage 3		1		2	**42**	2					47
Early Stage 4						**13**					13
Late Stage 4							**25**				25
Early Stage 5								**12**			12
Late Stage 5									**9**		9
Indet.			2		1					**141**	144
Total	4	22	41	84	65	16	29	14	9	145	429

Bold type indicates frequency of bifaces with equivalent extent of reduction on each face

At Locality 36, the only other Tosawihi site at which the reduction sequence has been investigated (Ataman 1992b: Table 23), the earlier stage profile of that assemblage allowed recognition of a much greater proportion of dorsal and ventral surfaces. There, a somewhat greater proportion of bifaces was reduced equally on each face, but the pattern through stages was similar to that at 26Ek5040 and, thus, does not suggest major differences in the sequence of reduction practiced at the two sites.

Heat-Treatment

Heat-treatment in the course of biface manufacture was common at non-quarry Tosawihi sites. Heat-treatment renders the percussion and pressure flaking of Tosawihi opalite easier to control, facilitating the production of thin bifaces and projectile points. When a flake or a tool is heat-treated the exterior surface retains its matte finish, but any subsequent flake scars exhibit a glossy, smooth surface characteristic of heat-treatment (but no color change). Comparison of those scars which are heat-altered and those which are not sometimes can reveal the point in the reduction sequence at which heat-treatment was undertaken (Ataman and Bloomer 1992).

Heat-treatment of Tosawihi opalite is recognized by changes in texture, transparency, and sheen of material revealed in post-treatment flake scars. Texture becomes smoother, appearance is less transparent and more glossy. On white and light-colored opalites, a high degree of heat-treatment is clearly apparent; under-heated artifacts are less easy to recognize. Heat-treatment recognition on local colored cherts is more problematic because the physical changes are less pronounced.

Among the 474 bifaces from 26Ek5040, 67% are definitely heat-treated, 12% are possibly heat-treated, and 21% are untreated (Table 15).

Table 15. Frequency of Heat-Treatment in Reduction Stages.

	Unheated Bifaces		Heated Bifaces		Possibly Heated Bifaces		
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Assemblage Total
Early Stage 2	1	50.00	1	50.00	0	0.00	2
Late Stage 2	9	45.00	10	50.00	1	5.00	20
Early Stage 3	18	36.00	25	50.00	7	14.00	50
Middle Stage 3	28	29.79	54	57.45	12	12.77	94
Late Stage 3	8	10.13	61	77.22	10	12.66	79
Early Stage 4	3	12.00	21	84.00	1	4.00	25
Late Stage 4	1	3.23	28	90.32	2	6.45	31
Early Stage 5	2	9.09	19	86.36	1	4.55	22
Late Stage 5	0	0.00	7	77.78	2	22.22	9
Indeterminate Stage	28	19.85	94	66.20	20	14.08	142
Total	98	20.55	320	67.51	56	11.81	474

The stage at which heat-treatment is initiated cannot be determined for the majority (58.3%) of those bifaces from 26Ek5040 with definite indications of heat-treatment, but heat-treatment of the remainder was undertaken during several reduction stages. Of the heat-treated specimens, more are heated as blanks than detached from untreated cores (Tables 16, 17). The proportion of heat-treatment increases as reduction proceeds. The proportion of heat-treated or possibly heated bifaces rises from 50% of early Stage 2 bifaces to 100% of finished tools (cf. Table 15).

Table 16. Stage of Heat-Treatment by Biface Reduction Stage.

	Biface Stage										
	Early Stage 2	Late Stage 2	Early Stage 3	Middle Stage 3	Late Stage 3	Early Stage 4	Late Stage 4	Early Stage 5	Late Stage 5	Indet.	Total
Heat-Treatment Stage											
Blank from Heat-treated core			4	3	1		1			2	11
Heat-treated as Blank but stage indeterminate		5	3	16	14	3	5	2		12	60
Heat-treated in Stage 2	1	3	4	4	3		1	2		3	21
Heat-treated during thinning but stage indeterminate			2	4	6	1		1		6	20
Heat-treated in Stage 3				3	1					2	6
Heat-treated Early Stage 3			6	4	1	1					12
Heat-treated Late Stage 3						1	1	1			3
Heat-treated Stage 4											
Post-manufacture thermal alteration											
Possibly Heat-treated		1	7	12	10	1	2	1	2	20	56
Not thermally altered	1	9	18	28	8	3	1	2	0	28	96
Heat-treated but stage indeterminate		2	7	20	35	15	20	13	7	68	186
Total	2	20	51	94	79	25	31	22	9	141	474

At sites excavated on the periphery of the Tosawihi Quarries, heat-treatment was initiated most often in Stage 3, probably between Middle and Late Stage 3 (Bloomer, Ataman, and Ingbar 1992), while at quarry sites such as Locality 36 (Ataman 1992b) very little heat-treatment was observed. We have concluded elsewhere (Ataman and Bloomer 1992), that at Tosawihi bifaces were transported from quarries in a partially finished (Early-Mid Stage 3), unheated state, and that they were subsequently heat-treated and further reduced before being exported from the Tosawihi vicinity.

Since the evidence indicating stage of heat-treatment (co-occurrence of matte and glossy flake scars) is removed in late stages of reduction, most bifaces in the 26Ek5040 assemblage are classed as possibly heat-treated or indeterminate. Sample size notwithstanding, at 26Ek5040 heat-treatment of bifaces was initiated over a wider range of stages than previously noted elsewhere at Tosawihi: as cores, unworked blanks, or edged blanks, as well as during thinning (cf. Table 17). While our interpretation of 26Ek5040 as a place where heat-treatment was undertaken is consistent with previous conclusions (Bloomer, Ataman, and Ingbar 1992; Ataman and Bloomer 1992), this wider range of representation may indicate a less standardized approach to biface manufacture than seen elsewhere in the Tosawihi vicinity.

Table 17. Summary of Heat-Treatment by Reduction Stage.

Biface Stage	Frequency
Pre-Stage 1	11
Stage 1 or 2	21
Early Stage 3	12
Late Stage 3	3
Stage 3	6
Stage 1,2,3,4, or 5	186
Stage 2,3,4, or 5	60
Stage 3 or 4	20
	319

Breakage

Observation of bifaces broken in various stage of manufacture, along with data from debitage studies, allows us to reconstruct production methods (Callahan 1979) and to identify reduction techniques that may be peculiar to particular features, sites, regions, or timeframes.

Bifaces fail for a variety of reasons: raw material flaws, knapping mistakes, unworkable edges or unacceptable proportions, thermal failure during heat-treatment. Reasons for discard are linked to these failures; some are functional (i.e., they no longer can proceed on the intended trajectory), some refer to cultural preference regarding size, proportion, or shape.

Here we consider material failures, thermal failures, and knapping errors; the remainder of breaks are due to indeterminate causes (Table 18). Material failures are ascribed to internal fracture planes, inclusions, and other flaws in the natural structure of the stone or induced by quarrying or post-quarrying processes. Thermal failures occur when bifaces are over-heated, weakening the basic fabric of the toolstone. Knapping errors include hinge fractures, edge collapses, and so on.

Table 18. Manufacture Failures in the Biface Assemblage.

Breakage Type	Frequency	Percentage
Unbroken	29	6.12
Hinge Break	7	1.48
Outre passe Failure	3	0.63
Fracture plane Failure	41	8.65
Material Flaw	49	10.34
Edge Collapse	96	20.25
Bending Break	140	29.54
Thermal Failure	40	8.44
Bending/Material Flaw	10	2.11
Bending/Fracture Plane	7	1.48
Bending/Thermal	6	1.27
Thermal/Material Flaw	4	0.84
Thermal/Fracture Plane	7	1.48
Other Multiple	5	1.05
Indeterminate	30	6.33
Total	474	100

Only 29 bifaces (6.2%) in the 26Ek5040 assemblage are whole. The remainder, to the benefit of the present analysis, are broken. Some were discarded when their dimensions reached unacceptable proportions during manufacture, others may be dull or exhausted tools. Some stages are poorly represented. Nevertheless, when breakage is considered by stage, the one clear pattern to emerge is that breakage increases with reduction stage from Early Stage 3 until Early Stage 4, where it levels off (Figure 27, Table 19). Perhaps significantly, the proportions of bifaces discarded due to unacceptable shape are higher in Early and Middle Stage 3 than are discards due to breakage (cf. Figure 27). Overall, approximately 25% of failures were due to material flaw, 21% to knapping error, and 12% to over-heating. Seven percent are attributable to a combination of these.

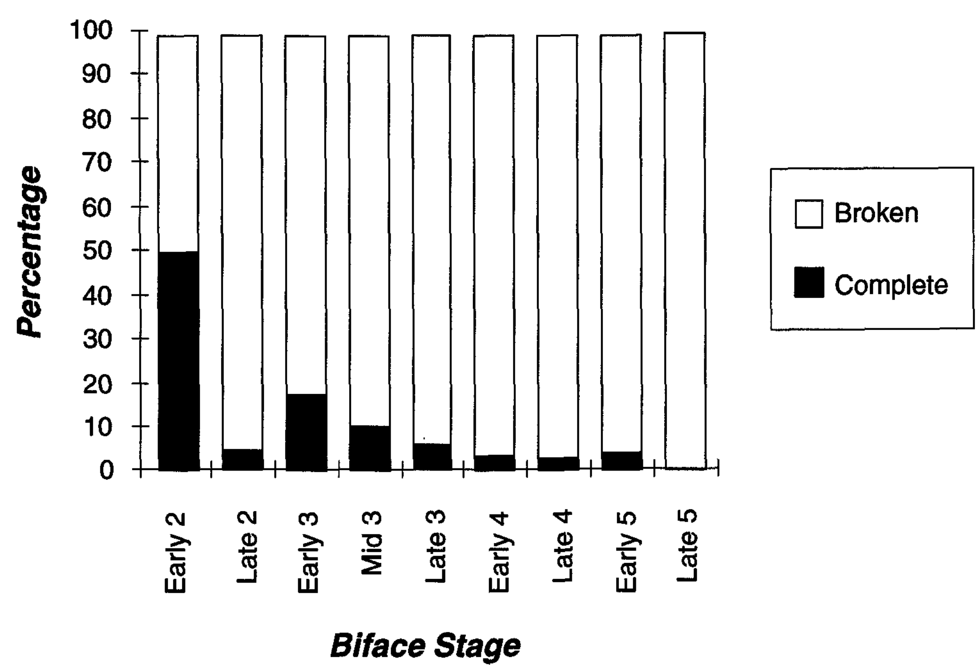

Figure 27. Biface breakage.

Table 19. Complete and Broken Bifaces by Stage.

Stage	Complete Frequency	Complete Percent	Broken Frequency	Broken Percent	Total
Early 2	1	50.00	1	50.00	2
Late 2	1	5.00	19	95.00	20
Early 3	9	17.65	42	82.35	51
Mid 3	10	10.64	84	89.36	94
Late 3	5	6.33	74	93.67	79
Early 4	1	4.00	24	96.00	25
Late 4	1	3.23	30	96.77	31
Early 5	1	4.55	21	95.45	22
Late 5	0	0.00	9	100.00	9
Indeterminate	0	0.00	141	100.00	141
Total	29	6.12	445	93.88	474

Biface Export

In previous work at Tosawihi we concluded that most prehistoric occupation of the area was of short duration related primarily to the procurement and processing of toolstone intended for use elsewhere (Elston 1992b). Thus, bifaces produced at Tosawihi were exported out of the area of production. One of the questions we are interested in addressing with the present analysis examines the form and stage of bifaces leaving 26Ek5040. Our previous work (Ataman 1992b; Ataman and Botkin 1991; Bloomer, Ataman, and Ingbar 1992) and other replication and archaeological studies of breakage have noted that successive stages of reduction, heat-treatment, and soft hammer use tend to increase breakage rates. If the incidence of broken pieces serves as proxy for breakage rates, various scenarios of export can be modeled.

We examine the question of export stage with several classes of data. We use incidence of breakage in each stage of the reduction sequence in the archaeological assemblage and observation of biface breakage in experimental replication to set up expectations about breakage. Then, from the proportion of the total represented by each stage in the archaeological assemblage (using only broken examples), breakage rates and export stages are modeled (Ataman and Botkin 1991; Ataman 1992b).

A simple mathematical simulation model of biface production uses insights gleaned from experimental flint knapping and the available archaeological data. We start with a pool of 1000 Stage 1 bifaces. The overall success rate (i.e., proportion of bifaces successfully reduced for transport) is fixed at 70%, a figure derived from experimental success rates (Ataman 1992b). Thus, sometime prior to transport, 300 bifaces must break. Their distribution across stages must match the observed archaeological distribution of biface stages.

Two conditions are allowed to vary in the simulation: breakage rate from one stage to the next, and number of bifaces leaving the assemblage at each stage. Breakage rates are determined, in part, by number of bifaces transported since these are removed from the pool of available bifaces. As noted above, breakage rates at 26Ek5040 seem to increase from Early Stage 3 through Early Stage 4, whereupon they level off somewhat. "Transporting" differing numbers of bifaces at each stage following Stage 2 (since there is no archaeological evidence for transport of Stage 1 or Stage 2 bifaces) causes breakage rates to change. Different export scenarios can be explored easily using this simulation. With the entire model in a spreadsheet, one simply changes the number of bifaces "transported" at each stage and examines the resulting breakage rates to see if they fit the pattern of the archaeologically and experimentally observed breakage rates.

Applying this technique to bifaces recovered elsewhere at Tosawihi, we concluded that 50% of the bifaces leaving the quarries were Middle Stage 3, 50% were Late Stage 3 or later, and most were heat-treated. (Ataman and Bloomer 1992). Examination of several museum collections from the greater Tosawihi region supported the conclusion that few, if any, Stage 1 or Stage 2 bifaces left Tosawihi for destinations outside the production area, that most transported bifaces were Middle Stage 3 or later, and that almost all of these were heat-treated. The export scenario revealed by the collection from 26EK5040 is somewhat different: most bifaces are exported at Middle or Late Stage 3 (more in Late Stage 3), as elsewhere at Tosawihi, but finished bifaces were exported as well.

Points and Preforms

This section describes the projectile point and preform assemblage from 26Ek5040 and discusses their manufacture, use, rejuvenation, and discard. In addition to functional considerations, the chronological value of projectile points in the Great Basin is well known (Heizer and Baumhoff 1961; Heizer and Hester 1978; O'Connell 1967; Clewlow 1967; Thomas 1971, 1981). Their relative dating can be used to construct local chronologies and to date associated geological strata. While several researchers (Flenniken 1985; Flenniken and Raymond 1986; Titmus and Woods 1986; Flenniken and Wilke 1989) question the validity of the current Great Basin projectile point sequence, suggesting that breakage and subsequent modification produce morphological variation sufficient to render many types poor temporal indicators, we found little in a large projectile point assemblage from the Tosawihi area to support this contention (Ataman and Drews 1992). The 26Ek5040 assemblage is too small to examine the question.

Projectile points can provide a framework in which to analyze temporal variation in technology, intensity of use, subsistence, mobility, and stylistic change. The chronological discussions below are descriptive, relating to point style and temporal sequence; a chronological synthesis and discussion of variation in activities is presented in Chapter 6.

For purposes of this study, preforms are defined as pieces discarded during the process of projectile point manufacture. Preforms for larger points often are indistinguishable from small bifacial tool preforms; such pieces here remain in the more general biface group. Distinctions between preforms and points were made on the basis of degree of finishing. Very small pressure-flaked tool fragments which could be remnants of projectile points or preforms, as well as of bifaces or flake tools, comprise a category of flake tool described later in this chapter.

Typology and Chronology

Test excavations generated nine projectile points and a preform, which are considered in later analyses. Here we examine the 34 projectile points and five preforms recovered by 1994 excavations at 26Ek5040, using Thomas's typological scheme (1981). Fifteen points are typeable (Figure 28); the remainder are out of key or fragmentary.

Large Side-notched Points. Thomas (1981) combines several side-notched variants (Northern, Bitterroot, Madeline Dunes, Elko, and Rose Spring; cf. Gruhn 1961; Swanson 1966; Riddell 1960; O'Connell 1975; Clewlow 1968; Heizer and Hester 1973) into one broadly defined series. Large Side-notched points are triangular in outline, with straight, concave, or notched bases. Notches are removed from sides rather than from corners of the blank. The series predates A.D. 1300, extending as far back as the No Name Phase (5000 B.C.) of the Upper Humboldt Valley sequence.

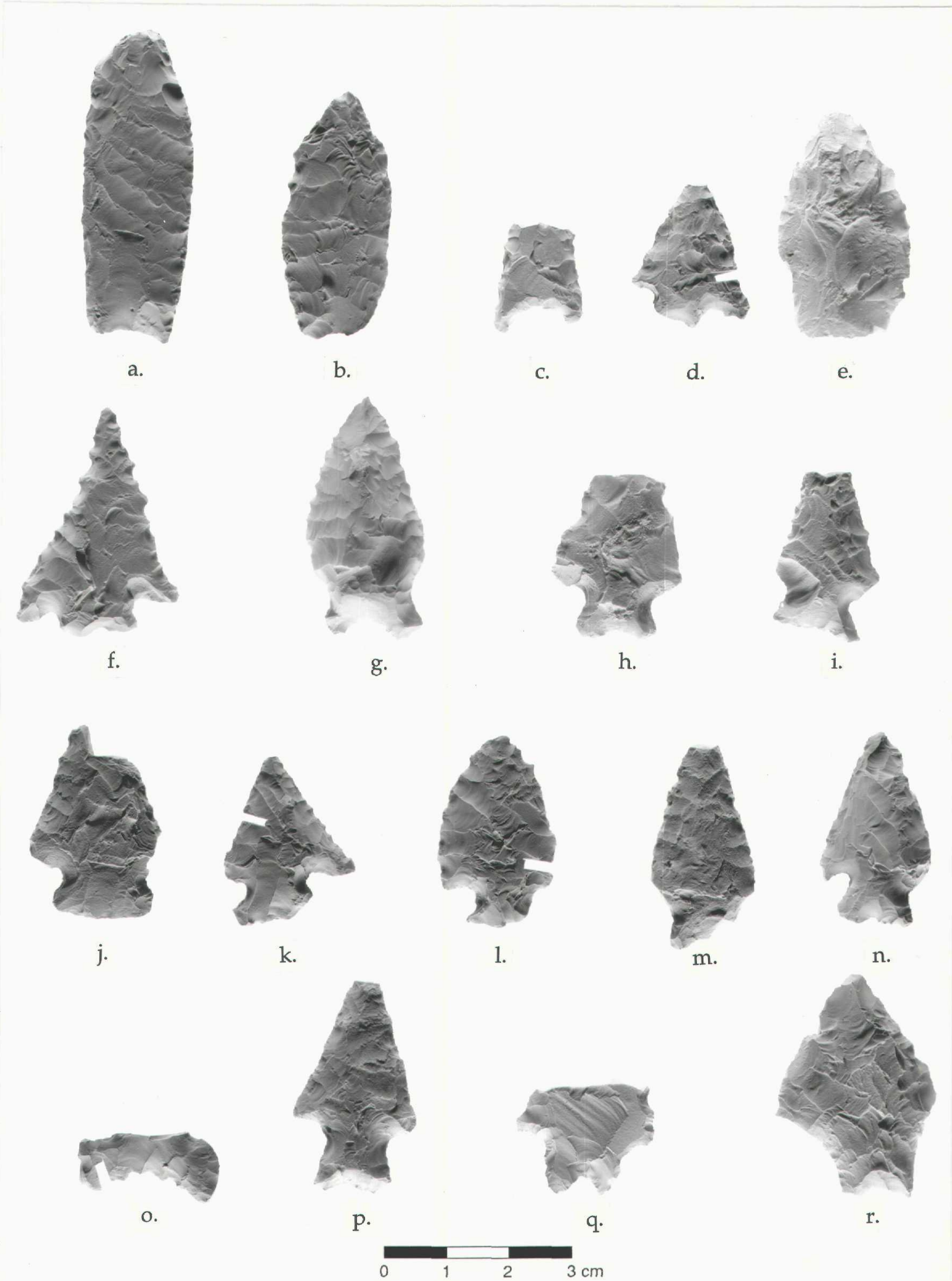

Figure 28. Selected projectile points, including all typeable specimens: a, b. Humboldt Series; c, e. out of key; d. fragment (Elko or Rosegate); f-n. Elko Series; o. Large/Northern Side Notch; p-r. Gatecliff Series.

One specimen was classified as a Large Side-notched point. It is an obsidian basal fragment broken through the notches and derives from an obsidian source at Pinto Peak or the Double H Mountains in northwestern Nevada. It's average hydration rind reading is 4.8 microns.

Humboldt Series. The Humboldt Series was defined by a surface assemblage at the Humboldt Lakebed site (Heizer and Clewlow 1968). Humboldt points are lanceolate, of variable size, with slight to deeply concave bases . Morphological variability and a broad temporal range renders them relatively poor time markers in the Great Basin. Dating between 3000 B.C. and A.D. 700 (Thomas 1981), the series spans several chronological phases of the Upper Humboldt Valley sequence.

Two specimens from 26Ek5040 are Humboldt points, one of Tosawihi opalite and the other of exotic chert. The opalite specimen has roughly parallel flaking extending to the midpoint while the more refined exotic chert specimen exhibits regular parallel diagonal flaking crossing the entire width of the point on one face. The latter specimen is basally thinned and has a distal impact fracture. One additional specimen is too small to fit the Humboldt key but resembles the type, as does one mid-section too fragmentary to type.

Gatecliff Series. A number of contracting stem and split stem forms appear in the Gatecliff Series. On the basis of similar morphologies, Thomas (1981) reclassified Elko Contracting Stem (Heizer and Baumhoff 1961) and Gypsum Cave points (Harrington 1933; Fowler, Madsen, and Hattori 1973; Heizer and Berger 1970) as Gatecliff Contracting Stem variants, and Pinto Points (Clewlow 1967; Heizer and Hester 1978; Thomas 1971) as Gatecliff Split Stem.

Three 26Ek5040 specimens, all made of Tosawihi opalite, are Gatecliff. Two are made of pink glassy opalite and one of white/pink speckled coarse material.

Elko Series. The Elko Series is comprised of Elko Corner-notched and Elko Eared types (Heizer and Baumhoff 1961; Heizer, Baumhoff and Clewlow 1968; Lanning 1963). Elko points are relatively large, triangular in outline, with deep corner notches and relatively straight, expanding (Corner-notched) or deeply notched (Eared) bases.

O'Connell (1967) demonstrated the utility of Elko points as time markers in the western Great Basin. Flenniken and Raymond (1986) warn that reworking of Elko points may obscure typological boundaries. The Series dates between 1300 B.C. and A.D. 700 (Thomas 1981); it represents the latter portion of the South Fork Phase and the entirety of the James Creek Phase of the Upper Humboldt sequence.

Elko Series points comprise more than one-half the classifiable points in the assemblage. Five are made of Tosawihi opalite, two of obsidian, and two of exotic chert. The Tosawihi examples include four white points and one caramel colored point with a clear impact fracture; all exhibit only minimal breakage. The obsidian specimens, both of which are nearly complete, derive from the Paradise Valley obsidian source; the hydration band of one measures 4.4 microns and the other 6.0 microns. The other exotics include a dark grey glassy chert specimen and one of a grey/brown coarse-textured material, possibly a rhyolitic tuff.

Rosegate Series. Rose Spring and Eastgate types have been combined to represent this series (Thomas 1981). Rose Spring Corner-notched points were defined by Lanning (1963) and named for the Rose Spring Site in southern Owens Valley; Wagon Jack Shelter, near Eastgate, Nevada is the type locality for Eastgate points (Heizer and Baumhoff 1961). Rosegate Points are assignable to the Maggie

Creek Phase of the Upper Humboldt Valley sequence; they represent a relatively short time span, dating between A.D. 700 and A.D. 1300 (Thomas 1981).

While no Rosegate points appear in the assemblage, one fragmentary obsidian point made of material from the Brown's Bench source with a hydration band of 5.3 microns no doubt would key to either Rosegate or Elko Series were it more complete.

Out of Key. Points complete enough to attempt to classify but failing to meet Thomas's key criteria, are "out of key." One square-based point, possibly unfinished, and one opalite point shaped like a Humboldt but too small to fit the key are included in this category. Our subjective speculations as to their origins appear above.

Fragments. Sixteen fragmentary points were recovered, mostly tip fragments. Twelve were made of local material, three of obsidian, and one of exotic chert. The obsidian was all from Paradise Valley with hydration bands measuring 4.7 and 6.0 microns, and one diffuse band. The exotic chert specimen is a dark, glassy material.

Raw Material

Raw materials used for points and preforms are summarized in Table 20. Most are opalite, with several obsidian and exotic chert specimens. Although the sample of projectile points is small, the incidence of exotic materials noted in Table 10 reflects differential patterns of raw material acquisition and utilization for bifaces and points. A low incidence of obsidian and exotic chert debitage indicates that some portion of the projectile points discarded at 26Ek5040 arrived there in a finished or partially finished form. No statistically significant relationships were noted between projectile point type and material type.

Table 20. Projectile Point Types by Raw Material.

Point Type	Tosawihi Opalite	Obsidian	Exotic Chert	Total
Elko	5	2	2	9
Gatecliff	3	0	0	3
Humboldt	1	0	1	2
Large Side-Notched	0	1	0	1
Out of Key	2	1	0	3
Fragment	12	3	1	16
Preforms	4		1	5
Total	27	7	5	39

Point Manufacture

Determining projectile point production techniques is sometimes difficult even in the presence of all stages of debitage and large point samples, of which neither condition prevails at 26Ek5040. Original blank form often is obscured by subsequent reduction, and few cores, which might elucidate blank form, were recovered. Since numerous types of flake tools are made on biface thinning flakes and since biface reduction is the most common reduction technique observed, it seems likely that at least some of the flakes on which preforms and projectile points are made were produced during biface reduction, regardless of the primary purpose of reduction. Blanks for larger point types should be derived from early stage biface manufacture, while blanks for smaller points could have been removed from bifaces during any stage of reduction (Ataman and Drews 1992).

It was once assumed that Early and Middle-Archaic dart points in the Great Basin were made on small percussion flaked bifaces, while Late Archaic arrow points were made on thin flake blanks reduced directly by pressure flaking (O'Connell 1967; Lanning 1963; Zerga and Elston 1990). This notion has been questioned by Novick (1987), Ataman and Drews (1992), and Ataman and Ingbar (1994), who observe that Early Archaic Gatecliff and Middle Archaic Elko points from central Nevada frequently exhibit remnants of the ventral surface of the flake blank and that, consequently, these point types at least occasionally were produced directly from flakes by pressure rather than from percussion flaked bifaces.

At 26Ek5040, 26% of projectile points show ventral detachment scars and 12% percussion flaking, suggesting that some points were made from bifacially percussion flaked preforms but most probably were made directly on flakes; we infer common use of flakes in point manufacture at 26Ek5040.

Resharpening and reworking extend the use life of larger points, making discard necessary only when a piece is broken beyond repair. Maintenance of the edges of smaller points is restricted by their size, so that their resharpening may be of limited utility; consequently, complete small points with worn or damaged edges may be discarded.

Thomas (1983) suggests that tool maintenance, redirection, and discard may signal the intensive, well planned resource exploitation associated with long term, seasonal occupation. But sites with assemblages reflecting the reuse and reworking of projectile points may just as well be short term, single component sites related to hunting. At 26EK5040, approximately 25% of recovered points show signs of reworking, recognized primarily by asymmetric or non-standard form. A similar proportion show impact fractures; these points probably were brought to the site after use, either in a carcass or still attached to an arrow or spear shaft.

Recognition of Manufacture, Use, and Reworking Locations at 26Ek5040

Unlike other classes of broken tools which may have been produced in one place, used in another, and discarded in a third, it is unlikely that broken preforms, irreparably broken points, and pressure flakes were intentionally transported anywhere. So, the distribution of these artifacts reflects intentional discard actions. Insofar as discard occurs in specific activity contexts, they are useful indicators of those activities. The relatively small number of points and preforms at 26Ek5040 precludes detailed analysis of specific loci function (cf. Chapter 3), but some general observations can be made.

Locations of manufacture, hunting/butchering, reworking, and base camp activity can be recognized in terms of the following indicators:

Manufacture Location. Preforms, which we define as unfinished points, usually are found broken in manufacture, so their presence at a particular locus probably is an indication of point or preform manufacture there or nearby. Similarly, concentrations of pressure flakes at a particular locus likely indicate an area of projectile point manufacture. Notching flakes (Titmus 1985), a specialized form of pressure flake, provide evidence for *in situ* point finishing or reworking. These, however, are very small and may escape recovery, leaving this flake type underrepresented in any particular assemblage.

Hunting/Butchering Location. Points lost or irreparably broken *during* hunting should be discarded near capture or processing locales. Those lost often are complete points. Points exhibiting use breakage are more common; they identify kill or butchery sites, sites where carcasses were processed or consumed, or places where points were reworked. Broken tips may have been transported to base camps in meat, or left among the waste portions of carcasses abandoned at kill or butchering sites. Tips and unrecognizable fragments can be produced by fragmentation on impact and are discarded when found in the meat. Point bases retained on the shaft are later discarded. Expectations concerning fragment types recovered in this particular activity area are discussed in greater detail below.

Retooling Location. A site containing primarily bases and/or pressure flakes can be interpreted as a place where hafted bases are removed and discarded, or are reworked at the tip. Other broken fragments may be in evidence, but tips should be rare. Expectations concerning fragment types recovered in this particular activity area are discussed in greater detail below.

Short-term Base Camp Location. A wide range of activities can be expected at a base camp, including point manufacture, retooling, butchering, and even storage of finished or partially finished points. Thus all fragment types, pressure debitage, and complete and broken preforms could appear in quantity at a base camp.

To reiterate, at point manufacturing sites preforms, points broken in manufacture, notching flakes, and pressure flaking debitage should be present. At retooling sites (at least those where notched points predominate) (cf. Ataman and Ingbar 1994), point assemblages should be dominated by bases and pressure debitage, while at hunting/butchering sites, point assemblages should contain tips, barbs, few bases, and indeterminate fragments; few complete points, and little pressure debitage should be present. When all these fragment types are present in similar proportions, all these activities are indicated, suggesting components of a more complex activity locus such as a base camp.

Fifty-nine percent of debitage samples from 26EK5040 contain pressure flakes, but only five preforms were recovered, one notching flake was noted, and no projectile points exhibit manufacture breaks (but note that many manufacturing breaks are not diagnostic). There is a high degree of fragmentation in the point assemblage (Table 21); only six points are complete and 17 specimens (some of which could have broken in manufacture) are too fragmentary to classify to type. Point fragments are of various types, suggesting generalized campsite activities, which might include butchering/consumption, manufacturing and retooling. The high degree of fragmentation could indicate butchering/consumption were the most common of these activities.

As noted above, differential patterns of raw material acquisition for points and bifaces suggests that some points arrived at 26Ek5040 in a finished or partially finished form. This observation, in conjunction with the proportion of points exhibiting reworking suggests that these items were highly curated tools: tools which were used, maintained, and discarded very differently from the bifaces manufactured and transported from the site and the quarry vicinity in general.

Table 21. Point Fragment Types.

	Frequency	Percent
Complete	6	17.65
Base	3	8.82
Tip Missing	4	11.76
Barb/Tang Missing	3	8.82
Tip	4	11.76
Base Missing	3	8.82
Mid-section	4	11.76
Lateral Fragment	1	2.94
Indeterminate	2	5.88
Multiple Breaks	4	11.76
Total	34	100.00

Flake Tool Technology

Flake tools are flaked stone tools exclusive of bifaces, preforms, and projectile points. At 26Ek5040, they are the second most common flaked stone tool type (after bifaces). Flake tool function is difficult to assign. Many flake tool assemblages, especially those recovered from the surface, provide only limited information on function because post-depositional alteration of micro-topographic wear surfaces obscures otherwise diagnostic polish and edge damage. The present study does not consider wear characteristics in the relatively small flake tool assemblage. We have attempted to exclude the more equivocal pieces from analysis, in favor of more heavily retouched items, but it often is impossible to distinguish deliberate or use-induced retouch from post-depositional retouch (Howes 1980; Young and Bamforth 1990); trampling and other post-depositional processes may produce macroscopic and microscopic edge damage mimicking deliberate and use-induced retouch (Flenniken and Haggarty 1979; Knudson 1979; Tringham et al. 1974).

We identify 15 morphological flake tool types, grouping them into six general tool classes. As described elsewhere (Ataman 1992a), flake tools are classified according to overall morphology and outline of working edge. While sharing some morphological attributes, pieces assigned to the same class may not have shared a common function. Nonetheless, the seemingly functional term "scraper" is used here because it describes a generally recognized tool class. We use this term explicitly, to denote a common morphology (flakes with continuous abrupt or semi-abrupt retouch serving to strengthen or regularize a straight or convex edge) and disavow implied functional characterizations. Three categories of scraper-like tools are included among the morphological types: side-scrapers and end-scrapers (Figure 29) were defined by the location of retouch on the blank, and a category of miscellaneous and fragmentary scraper specimens was established.

Three categories of pointed tools include specimens commonly called perforators, awls, drills, and gravers. Because these terms often are used interchangeably, and to avoid functional ascriptions, morphologically descriptive terms are used instead; we recognized elongate and short symmetrically pointed tools, and asymmetrically pointed tools (cf. Figure 29).

Pieces exhibiting notches (Figure 30) are assigned to one tool class. Two categories of flake tools exhibit bifacially worked edges (straight or sinuous edge profiles) (cf. Figure 30), distinguished from bifaces by their pressure flaking, which most often is not invasive, and by the frequently regularized edge.

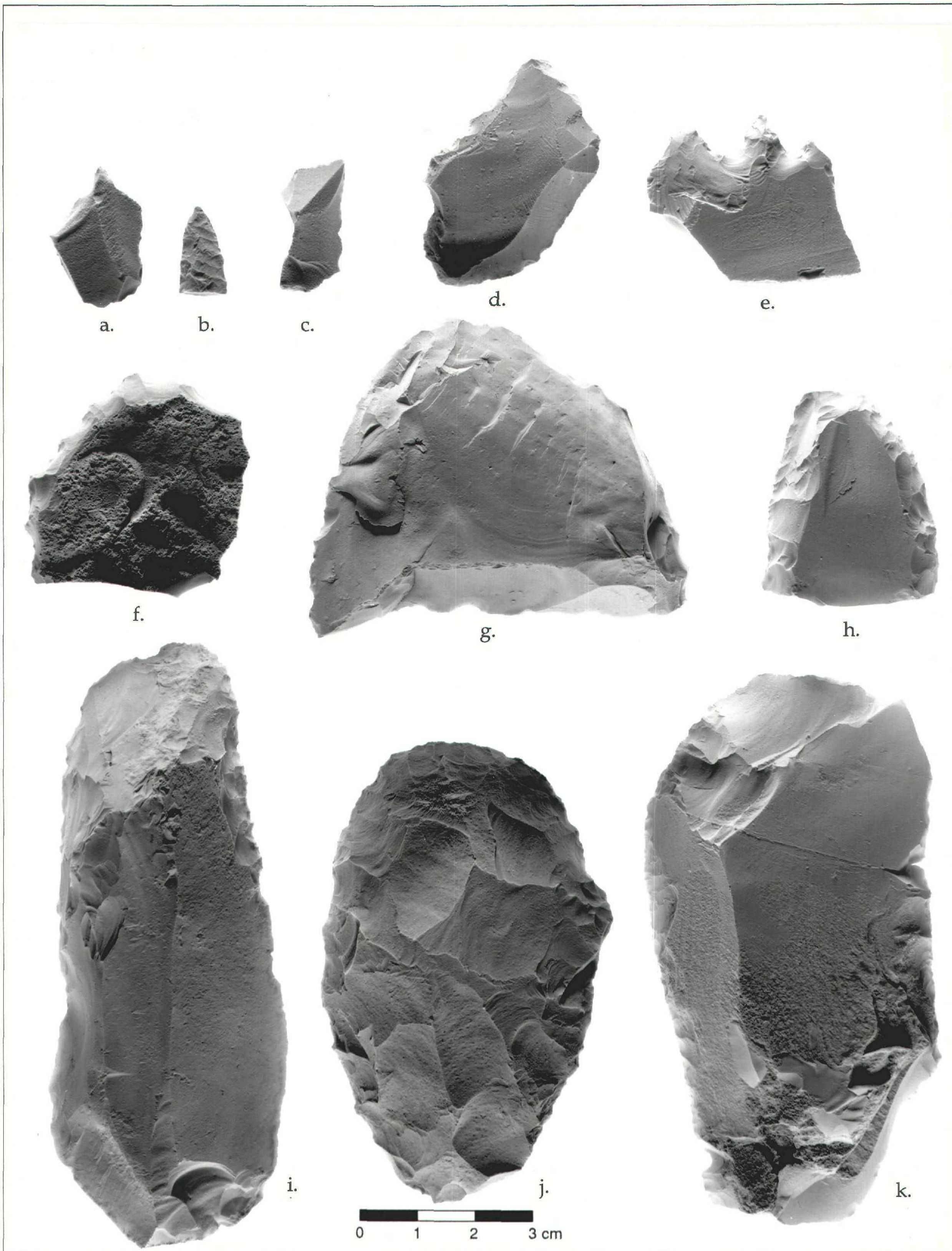

Figure 29. Selected scrapers and pointed tools. a-e. pointed tools; g, i, k. side scrapers; f, h, j. end scrapers.

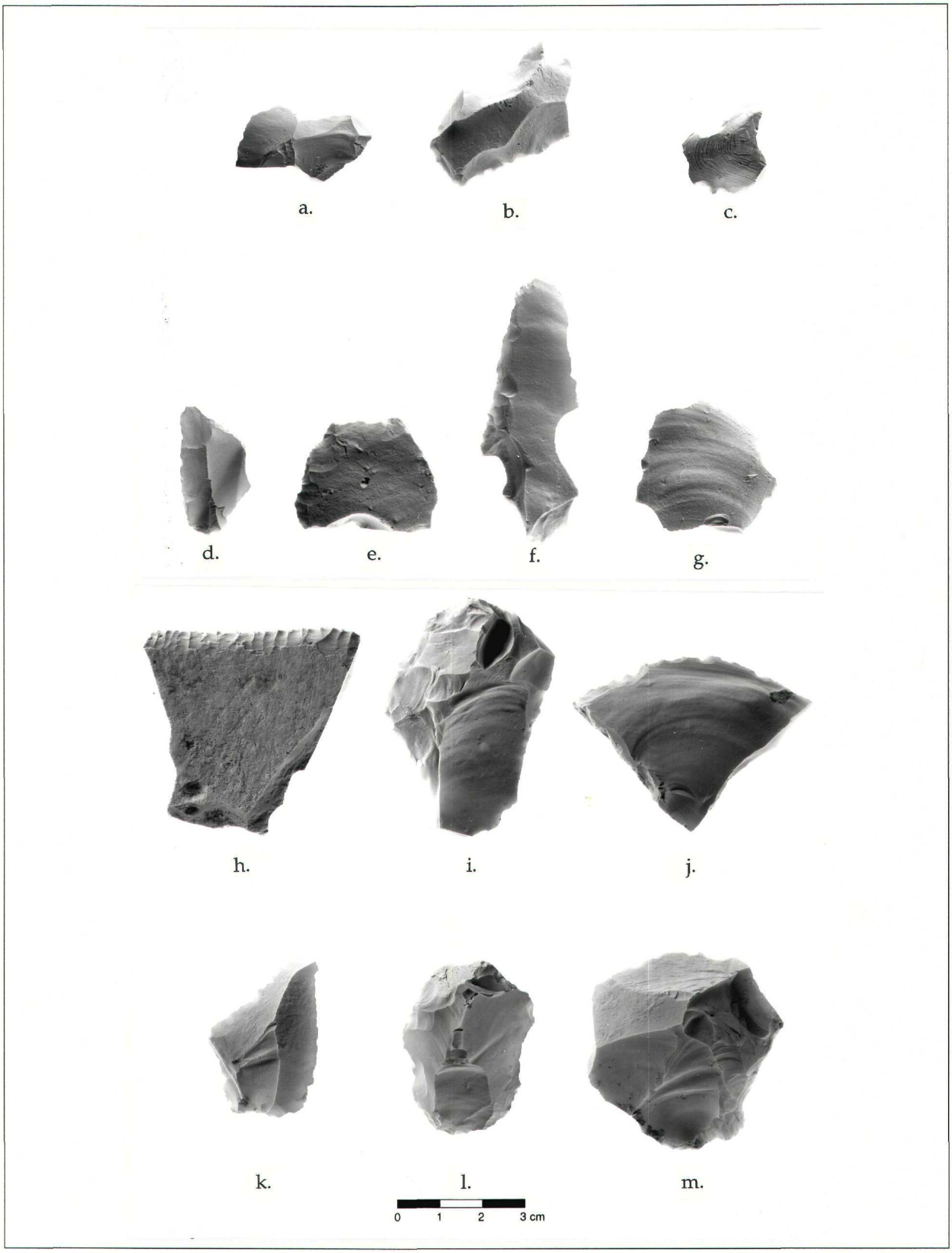

Figure 30. Selected notched tools (a-c.), retouched flakes (d-g. and k-e.), and bifacial flake tools (h-j.).

Retouched flakes are segregated by extent and location of retouch. We recognize five categories: flakes with continuous or localized retouch on one edge, those with continuous or localized retouch on multiple edges, and those with variable retouch patterns on multiple edges (cf. Figure 30).

In addition to these, summarized in Table 22, we assign to yet another category tools which fit none of these groups, and tally as well pressure flaked pieces too fragmentary to classify. Of 173 flake tools, most (50%) are retouched flakes without formal shapes, but scrapers (14%) and notched tools (10%) are proportionally significant.

Table 22. Flake Tool Type and Raw Material.

	Material				
Morphological Type	Tosawihi Chert	Exotic Chert	Basalt	Other	Total
Side-scraper	12				12
End-scraper	4				4
Misc. scraper	8	1			9
Symmetrically pointed elongate	1				1
Symmetrically pointed short	2				2
Asymmetrically pointed	2				2
Notch/denticulate	16		1		17
Bifacial with straight profile	2	1			3
Bifacial with sinuous profile	6		1		7
Flake with continuous retouch on 1 edge	39			1	40
Flake with continuous retouch on >1 edge	11				11
Flake with localized retouch 1 edge	21				21
Flake with variable retouch pattern	17				17
Pressure flaked tool fragment	18				18
Flaked percussion tool	0		1		1
Other	2		2		4
Indeterminate	4				4
	165	2	5	1	173

Manufacture

Several aspects of flake tool manufacture were examined, including material preference, blank selection, and thermal alteration. As noted above, the vast majority of flake tools were made of the local chert. There are a few (n=5) basalt tools and even fewer (n=2) made of exotic material. Unlike other categories of flaked stone tools at 26Ek5040, none is obsidian.

Approximately one-half the blanks of flake tools could not be identified, but the remainder are made on core reduction flakes, biface thinning flakes, angular chunks, and tabular pieces. Blank form is related to tool type (Table 23). Scrapers, which are larger than most other flake tools, are more often made on core reduction flakes, while notched tools and miscellaneous retouched flaked are more commonly made on biface thinning flakes. Since many miscellaneous retouched flakes and pressure flaked fragments are made on flakes whose type cannot be determined, we infer that scrapers are more formal tools and most of the other types present more expedient.

Table 23. Flake Tool Blank Types.

	Indeterminate Flake	Core Reduction Flake	Biface Thinning Flake	Angular Chunk	Tabular Piece	Total
Scrapers	8	13	4	0	0	25
Pointed Tools	4	0	1	0	0	5
Notched Tools	4	3	9	1	0	17
Bifacial Tools	6	2	1	0	1	10
Misc. Retouched Flakes	42	8	32	7	0	89
Pressure Flaked frags	18	0	0	0	0	18
Other	1	1	0	1	2	5
Indeterminate	4	0	0	0	0	4
	87	27	47	9	3	173

Heat-treatment is also related to tool type and blank type (Table 24). Scrapers (which are detached from cores) are less often heat-treated. This may be due both to function, where more brittle tool material is less desirable, and to size, inasmuch as flakes removed from a mid-stage or later stage biface are smaller than those chosen for the manufacture of formal tools. Pressure flaked fragments, which usually are heat-treated, were most frequently heated as flakes, and miscellaneous retouched flakes are detached from heat-treated cores, probably bifaces.

Table 24. Heat-treatment of Flake Tools.

Flake Tool Type	Detached from Heat-treated Core	Heat-treated as a Flake	Heat-treated at an Indeterminate Stage	Possibly Heat-treated	Not Heat-treated	Total
Scrapers	2	1	1	3	18	25
Pointed Tools	2	1	0	1	1	5
Notched Tools	3	0	0	7	7	17
Bifacial Tools	0	2	0	3	5	10
Misc. Retouched Flakes	22	4	5	21	37	89
Pressure Flaked Frags	2	5	3	6	2	18
Other		1	0	0	4	5
Indeterminate			1	1	2	4
	31	14	10	42	76	173

Percussion Tools

The percussion tools from 26Ek5040 are few (n=10) but morphologically diverse; four distinct types are identified (hammerstones, basalt slabs, battered flake tools, other battered tools). Analysis of the percussion tools was designed to explore the kind, length, and intensity of tool use through focus on four main attributes: angle of the working edge, location of wear, extent of wear, and intensity of wear. Extent of wear assesses the percentage of overall surface that has been modified by use and the percentage of the edges that have been modified. Intensity of wear is a more subjective attribute used to describe the degree to which a tool has been used based on a combination of the types of wear present and the degree of edge damage; it is recorded on a relative scale from low to high. Broadly, the edge angle and location of wear may help illuminate the ways in which a tool was used while extent and intensity of wear help determine to what degree a task may have been pursued at a particular location.

Hammerstones

Hammerstones, stones battered by use in lithic tool reduction, ground stone resharpening, and other percussive tasks, are common on Great Basin sites and have been found throughout the Tosawihi region (Schmitt 1992a; Schmitt and Carroll 1992). Four were recovered from 26Ek5040 (Table 25). Three are cobbles of basalt, and one is of quartzite; all are ovoid to irregular in shape, with battered edges. Figure 31 illustrates one such hammerstone.

Table 25. Attributes of Percussion Tools.

	Material	Working Edge Angle	% Surface Battered	% Edges Battered	Intensity of Use
Hammerstones					
0-0-94.52	Basalt	Obtuse/rounded	10	75	Moderate
Q8-3-1.12	Basalt	Obtuse	Indeterminate	Indeterminate	Low
W1-1-2.1	Quartzite	Rounded	Indeterminate	Indeterminate	Moderate
TC-0-1.1	Basalt	Obtuse	5	25	High
Basalt Slabs					
MS1-0-1.3	Basalt	Acute	Indeterminate	Indeterminate	Low
MS1-0-1.5	Basalt	Acute	10	Indeterminate	Mixed
Battered Flake Tools					
0-0-94.79	Opalite	Rounded	5	45	Mixed
AG1-4-1.6	Opalite	Acute	Indeterminate	Indeterminate	Low
Other Battered Tools					
0-0-94.264	Welded Tuff	Rounded	5	0	Moderate
MS2-0-1.7	Basalt	Rounded	Indeterminate	Indeterminate	High

Wear is generally confined to the borders or lateral edges, though in one case it is located on one end. The angle of the working surfaces on hammerstones ranges from obtuse to rounded. Extent of edge use on these tools proved minimally informative since it was so variable, ranging from indeterminate to 75% of available edges. Intensity of use was also highly variable, including one minimally and one moderately used piece and two highly worn tools (cf. Table 25). Wear consisted of crushing and battering on all tools with the addition of spalling and flaking on the heavily battered tool.

A quartzite specimen (W1-1-2.1) may be a pestle fragment inasmuch as wear is confined to one end and there is a small ground patch on one edge which may represent shaping. However, quartzite is common among Tosawihi hammerstones, and the ovoid shape of this specimen is more typical of Great Basin hammerstones. A minimally battered tool (Q8-3-1.12) may be a hammerstone spall.

Figure 31. Hammerstone with impact fractures.

These hammerstones were most likely used for early reduction tasks such as core reduction, blank preparation, and early biface thinning. Since blanks for hammerstones are readily available in the numerous drainages in the Tosawihi area, their infrequency suggests early reduction did not dominate reduction activity at 26Ek5040. Indeed, analysis of the debitage (cf. Chapter 5) suggests that early reduction was less common than biface thinning and shaping.

Battered Basalt Slabs

Two fragmentary battered basalt slabs (Figure 32) were found during mechanical scraping. These two fragments do not refit but seem, nevertheless, to be elements of the same tool. Use has caused spalling, crushing, and battering of the acutely angled edges of both fragments. Some step fracturing and microflaking is present. The intensity of battering is variable, with specimen MS1-0-1.3 evincing only light use but specimen MS1-0-1.5 exhibiting a mixed pattern of use ranging from moderate to high (cf. Table 25). These tools resemble battered basalt slabs recovered elsewhere at Tosawihi and interpreted as quarrying tools (Schmitt and Carroll 1992:121-123).

Battered Flake Tools

Two opalite flake tools exhibit step fracturing on the flaked edge (cf. Table 25). One has a steeply angled scraper-like edge which is battered and step fractured; the intensity of this wear varies along the worked edge. An adjacent rounded surface and side are also battered. Wear suggests use as a chopping tool.

The other is step fractured from use as a battering tool along a 3 cm long, flaked, acute angle edge; the intensity of wear is low. The presence of battering wear on such a small tool edge is unusual; its function is unknown.

Other Battered Tools

This category includes a mano-hammerstone and a battered basalt cobble (Figure 33). The mano-hammerstone is described here rather than with the ground stone section because its last use was as a percussion tool (Figure 33b). It is a cobble of welded tuff of which two convex surfaces have been used in grinding functions; the smaller of the two ground surfaces is battered as well. Unlike other tools in the percussion tool category, none of the edges of this piece have been used. One end may be battered but the wear is minimal and equivocal. The moderately battered facet is located adjacent the ground facet and partially obliterates it. Wear is centered on the highest point of the rounded surface meaning, essentially, that a very broad "edge" was used to batter. A hammerstone with a similar wear pattern from Tosawihi has been interpreted as a percussor for bipolar reduction (Schmitt 1992a:275), but the softness and lightness of welded tuff makes this an unlikely use for the present tool. Wear could be from use as an anvil stone or to break resistant materials such as bone or seeds.

The second tool is a roughly cylindrical piece of basalt, broken at one end (Figure 33a). One hundred percent of the extant edges of the fragment have been battered (cf. Table 25). These rounded edges, which run along the cylinder's length, exhibit a high degree of wear consisting of spalling, crushing, battering, pitting, and step fracturing. Its possible function is unknown.

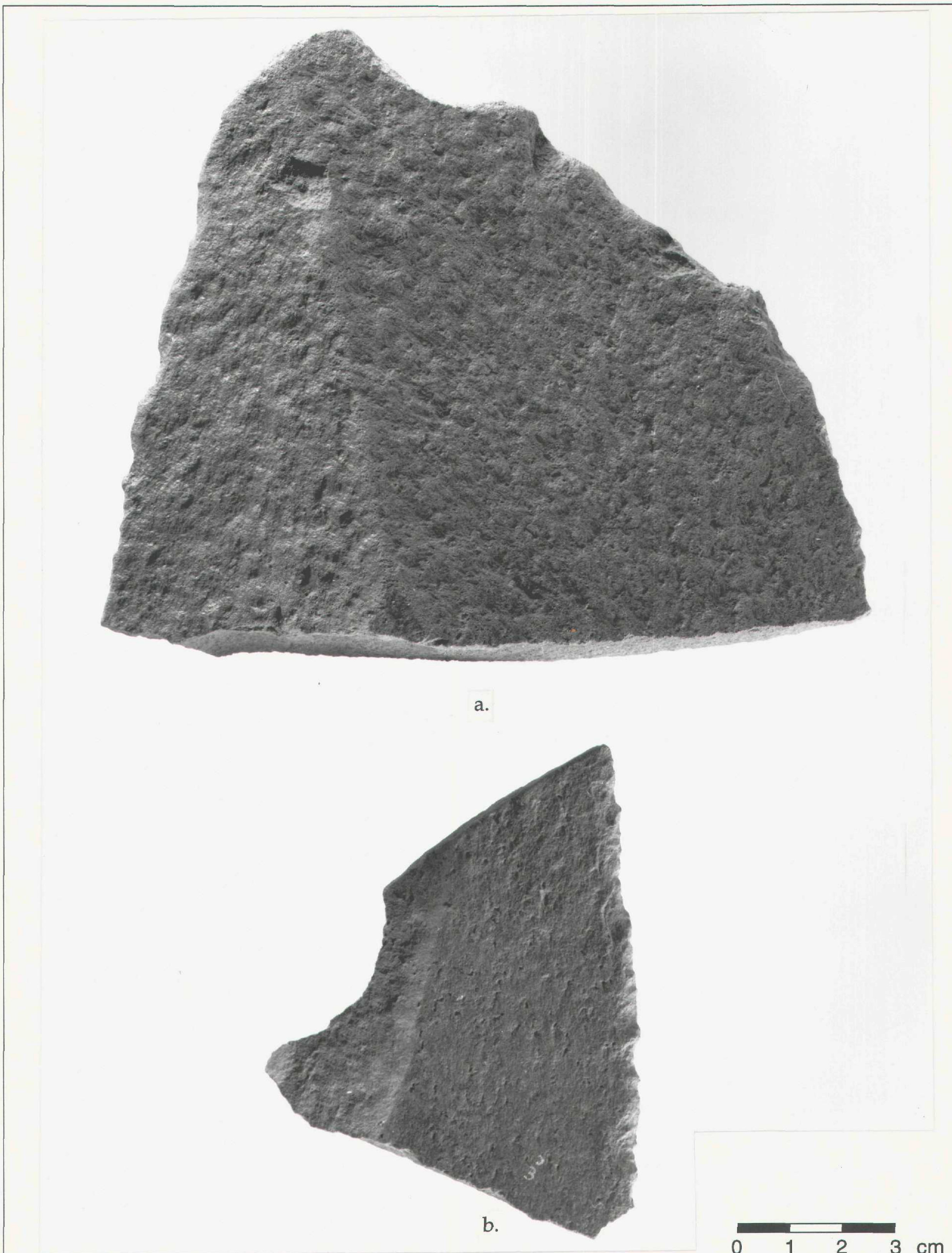

Figure 32. Battered slabs.

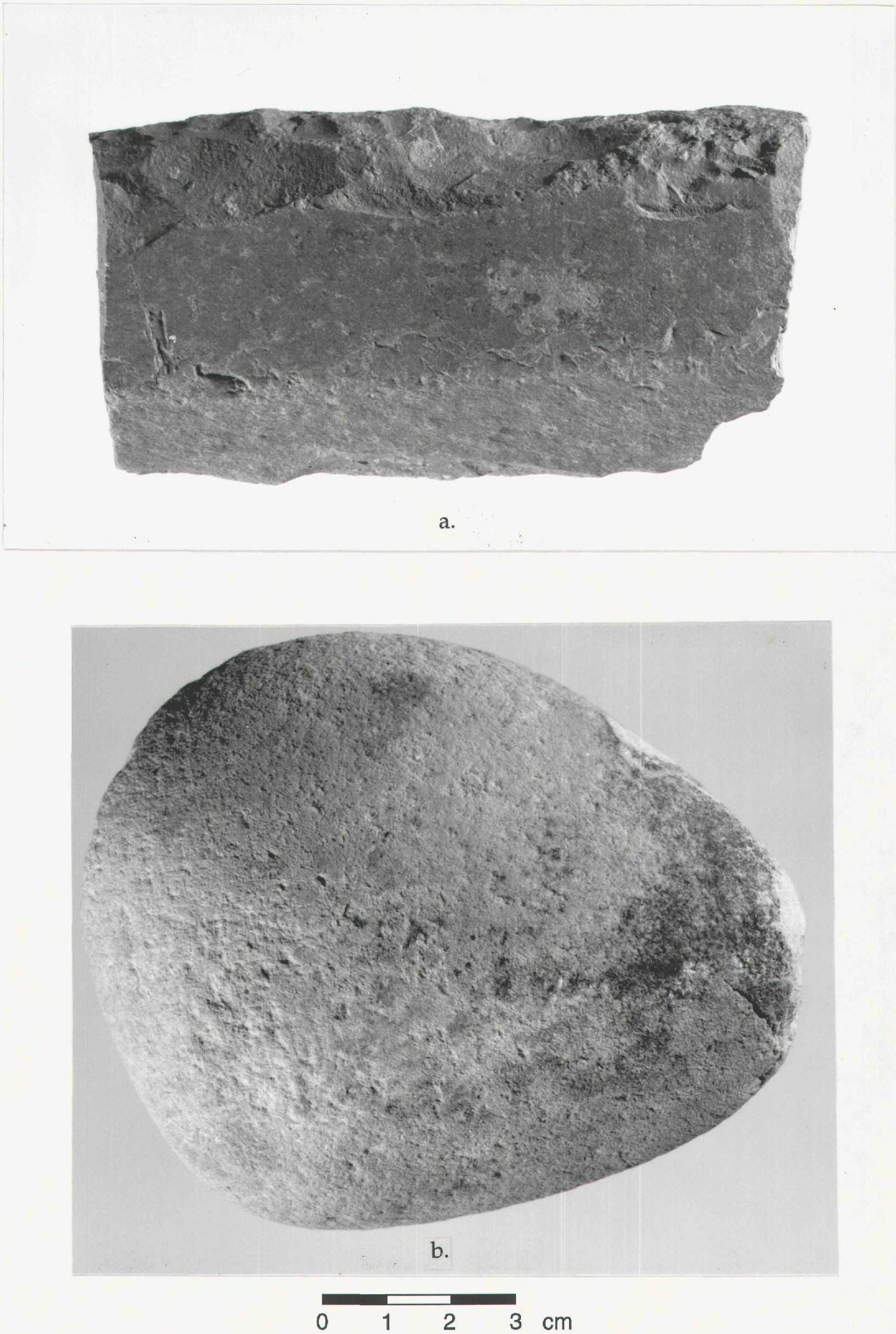

Figure 33. Other battered artifacts: a. cylindrical basalt heavily battered object; b. welded tuff cobble with flat battered surface.

Ground Stone Tools

Thirty-six pieces of ground stone were collected, 20 as surface isolates and the remainder from below surface. Four additional pieces were surface collected in 1992 (Ataman et al. 1992:34). Though a number of tool types are represented in this assemblage, several broad trends crosscut categories. Basalt (including andesitic basalt) is the most common raw material (55.5%), followed by rhyolite (16.6%; Table 26). Welded tuff, tuff, and quartzite are also represented. Formal shaping appears only on one pestle; one quartzite mano has a ground edge facet, but this is believed to be from use rather than manufacture (see below). The ground stone assemblage is highly fragmentary; only five complete tools were recovered. Unifacially worn tools predominate and use surface profiles are generally planar, although irregular and convex surfaces are present. Modifications other than grinding wear include striations on two tools, battering on three pieces, ochre staining on a mano, and fire-cracking of two tools.

Table 26. Raw Material of Groundstone Tools.

	Basalt/ Andesitic Basalt	Rhyolite	Tuff	Welded Tuff	Quartzite	Other	Total
Manos				3	1		4
Metates:							
Block	1	1					2
Slab	6						6
Boulder	1	1				1	3
Metate Frag.	3	2					5
Mortar			1				1
Pestle				1			1
Groundstone Fragment	9	2		1			12
Anomalous					1		1
Total	20	6	1	5	2	1	35

Analysis of the ground stone was designed to explore morphological variation as well as differences in use-wear facet shape, size, and intensity of use. Types in this analysis are based on morphological characteristics and do not necessarily indicate a specific mode of use (e.g., mortars are tools with circular to oval concave wear facets; wear may be from pounding or grinding). Analysis of the use wear facets focused on two attributes: the *extent* of the use wear facet relative to the surface area available and the *intensity* of wear present. Intensity of wear is a relative scale based on a continuum from minimal (little surface modification, wear difficult to see or feel) to high (highly polished, entire facet surface looks modified/slick). Tracking use wear facet extent proved minimally informative for this analysis because of the lack of complete specimens. Intensity of wear fell most often in the moderate to high range.

Manos

Four manos were recovered during excavation; two fragments refit and are counted as one item. The selection of quartzite and welded tuff for these tools contrasts with the ground stone assemblage as a whole where basalt is selected more often (cf. Table 26). Selection of these less common materials may refer to raw material form, inasmuch as rhyolite and basalt in this area occur as slabs or angular chunks rather than small cobbles suitable for handstone use.

None of the manos has been formally shaped. The quartzite mano (Figure 34b), however, has a highly polished, flat, shouldered facet on one edge; the degree of wear is such that it has altered the plan-view outline of the tool from oval to plano-convex. This facet is from use rather than manufacture. The function of this tool is unknown, but facet shape and location suggest it was a scraping or rubbing tool. Three similar edge facets appear on a second quartzite cobble from 26Ek5040, as discussed below.

Mano use wear facets are fairly uniform: oval in outline, covering 75% of the available surface, and exhibiting moderate to high intensity wear. Modifications other than grinding include ochre staining on one specimen (Figure 34a), and high intensity bifacial wear, and pecking or battering on the non-use surface of another. The exterior of the latter is badly weathered making it difficult to separate cultural and natural wear.

Metates

Six slab, two block, and three boulder metates were collected (cf. Table 26). Four additional slab metate fragments were recovered during testing (Ataman et al. 1992). These metate types refer not to function, but to original shape of the raw material used. Like the manos, none of these tools appears shaped or otherwise manufactured. They are made from unmodified locally available raw materials. All but one are fragmentary unifacial tools of basalt or rhyolite (cf. Table 26) with planar use surface profiles. Wear intensity ranges from light to high, though moderate wear is most common; extent of wear proved fruitless for analytical purposes as most tools were fragmentary. Unusual wear types include minimal flaking and battering on the edge of one broken slab metate; wear echoes that of the possible quarrying tools described in the hammerstone section above. Battering appears to have occurred after the piece was broken.

Striations were noted on two tools, one a boulder of tuff with striations on both convex surfaces and grinding on one. The presence of striations on this piece may be due to the softness of the raw material. Another metate exhibits striations on the ground facet, accompanied by high intensity wear.

Metate fragments (cf. Table 26) include five tools too fragmentary to determine the original form of the raw material. All are unifacial; use wear facet profiles range from planar (n=3), to concave (n=1) and convex (n=1). Wear is light to moderate in intensity. Wear on two fragments is notable. On specimen AG1-2-2.1 wear is confined to a pockmarked, wavy, convex surface although the opposite side of the tool is flatter, more smooth, presumably a better grinding surface. This tool probably is an edge remnant from a much larger tool. One metate fragment (AH2-7-3.1) has only a small (2.5 x 4 cm) wear facet on one broken edge although the available surface area is quite large. This fragment is also most likely part of a much larger piece.

The high degree of fragmentation in this assemblage is intriguing. The predominance of moderate intensity wear does not suggest that the tools broke solely from grinding fatigue. Fire-cracking and staining is not found on these tools. A combination of grinding fatigue and natural processes such as freeze-thaw cycles may be responsible for the breakage. On the other hand, use-wear replication studies have shown that basalt slabs of the type used for ground stone at 26Ek5040 require frequent resharpening to maintain grinding efficiency (Bullock 1994b). Frequent pecking to resharpen tools may have contributed to tool breakage.

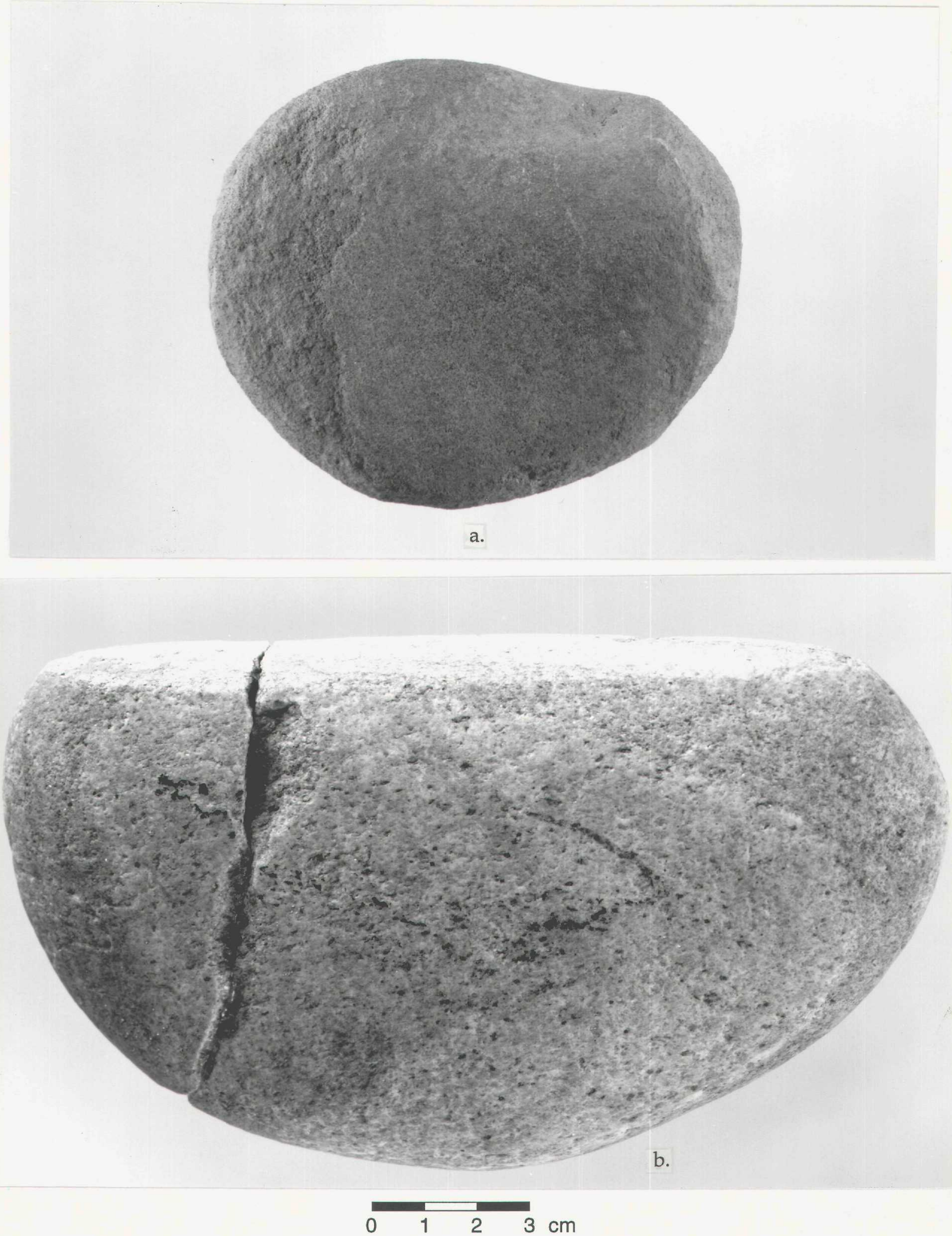

Figure 34. Selected manos: a. mano with ochre staining; b. mano with heavily polished flat facet.

Mortar and Pestle

The only mortar from 26Ek5040 is a piece of tuff with an oval, concave use surface. Wear on the facet is from grinding rather than pounding. The mortar is fragmentary, measuring 13.6 cm in length and 12.8 cm wide; the wear facet is 5.5 centimeters in diameter. The mortar cup is shallow but its high polish argues against an incipient mortar surface.

A complete pestle (Figure 35) was recovered from the backhoe bucket during excavation of Trench D. The pestle is 26.4 cm long and 9.2 cm wide (cf. Figure 35). It is an elongated cobble of welded tuff, oval in plan and in cross-section. It has been shaped by grinding along one edge, and possibly on others but the surface is too badly weathered to tell accurately. One end of the pestle is subrectangular in outline, flattened by use, polished and battered with some signs of spalling and flaking. Again, extensive weathering has confused or obliterated wear traces. The other end of the pestle is rounded but appears unworn.

Trifacially Ground Cobble

This quartzite cobble is faceted on three edges; the convex faces are unmodified. Facets consist of linear bands ranging from 5.1 to 7 cm in length and 0.6 to 1.0 cm in width. The surfaces of all three ground edge facets are flattened, highly polished, and noticeably shouldered from wear. Two of the three facets have been truncated by breaks or spalls. As mentioned previously, these facets resemble the edge facet on the quartzite mano (specimen 0-0-94.270/271) in both morphology and wear. It is unknown what kind of use left these wear traces, but they may be from use as a scraping or rubbing tool.

Ground Stone Fragments

Twelve pieces of ground stone were too fragmentary to type. All are unifacial with wear on the majority ranging from moderate to high. Wear on three, however, is marginal and may be natural. The more unusual pieces include specimen 0-0-94.265, which has scratches across both surfaces; microscopically (10X) these appear to be features of the rock's cortex rather than from wear. Specimen 0-0-94.167 is a small (8.7 x 6.5 cm) irregularly shaped rock with a tiny ground facet on one uneven surface; its use is unknown. Finally, though fragmentary, the projected size and shape of the complete tool represented by fragment Q5-3-2.1 would classify it as a palette; its length and width fall well below the mean for other metate types.

Summary of Ground Stone Tools

The ground stone tools from 26Ek5040 are of local materials invested with minimal manufacturing effort. A variety of ground stone types represents a variety of grinding tasks. The high degree of fragmentation in the collection is puzzling, perhaps attributable to the harsh, changeable winters of the Tosawihi area.

The ground stone assemblage from 26Ek5040 varies in a number of aspects from collections at other sites in and peripheral to the Tosawihi Quarries. Ground stone is proportionally more abundant here than at other Tosawihi sites (Schmitt 1992b:283; Schmitt and Carroll 1992:119). The lack of shaping is also distinctive, particularly among slab metates which, elsewhere in the quarries, were all shaped (Schmitt 1992b:284). Much of the ground stone recovered from sites peripheral to the quarries was battered, particularly the manos (Schmitt 1992b:284). Battering is not a feature of the ground stone tools from 26Ek5040. Finally, wear on the ground stone from the periphery sites was minimal for the most part (Schmitt 1992b:284) but moderately intensive at 26Ek5040.

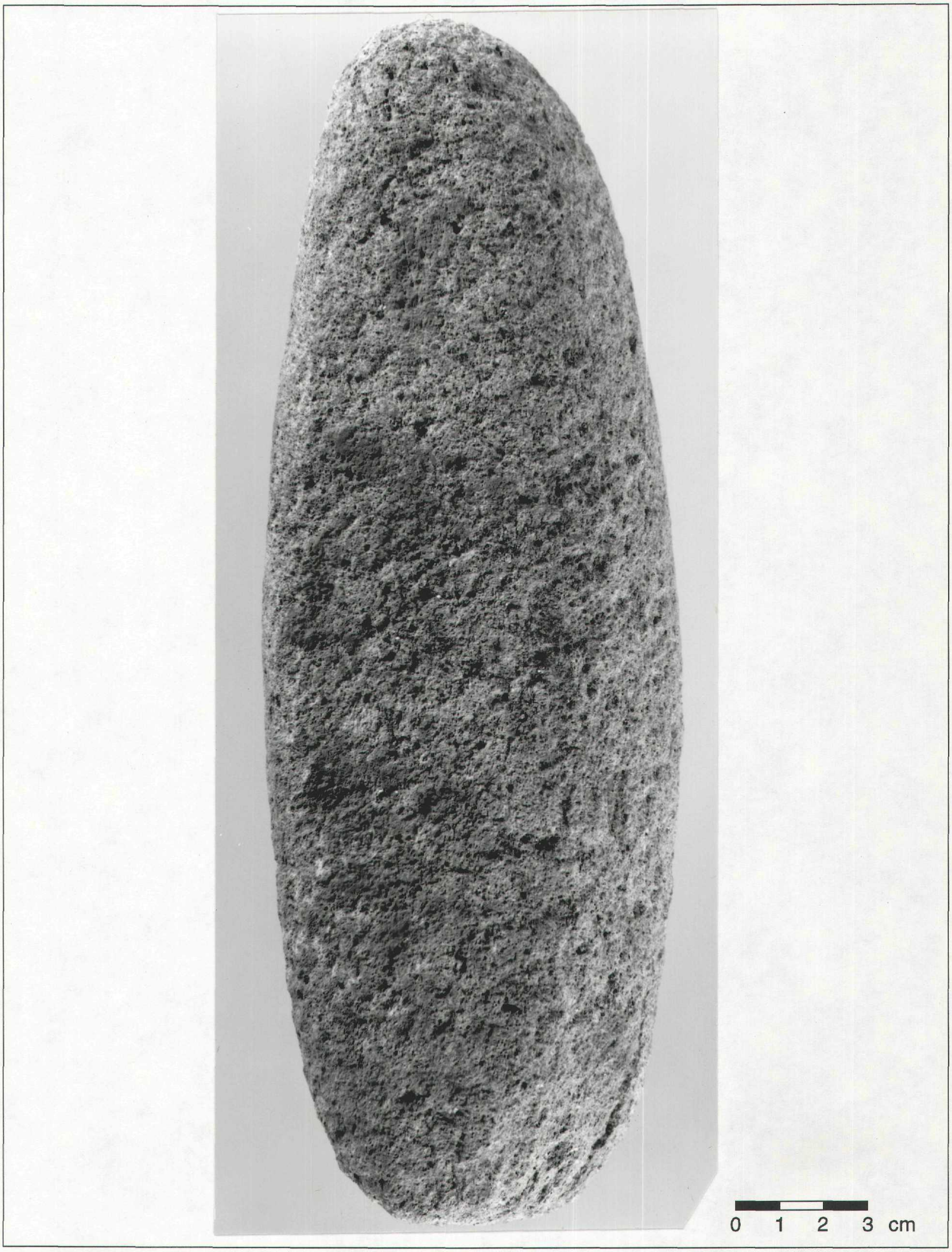

Figure 35. Pestle.

Some characteristics of the 26Ek5040 assemblage do resemble other Tosawihi ground stone collections. Local materials predominate and unifacial wear is most common for both manos and metates. Mortars with small polished surfaces like the one recovered at 26Ek5040, and similar cobble pestles have been observed (Schmitt 1992b:287-288).

Because this ground stone assemblage was highly fragmentary, variations in use wear facet shape, extent, and intensity provided only equivocal information. The larger, more diverse ground stone assemblage at this site relative to other Tosawihi sites suggests more attention to plant resources.

Chapter 5

TRAJECTORIES OF DEBITAGE AND TOOL PRODUCTION

Kathryn Ataman

By-products of flaked stone tool manufacture include tools broken in manufacture and reworking, cores, modified chunks, and debitage. The tools of 26Ek5040 are discussed in the previous chapter; here by-products of their manufacture are examined. Relative frequencies of debitage types and other by-products provide information about site-specific activities beyond that available from the study of tools alone. In addition to identifying loci of lithic reduction, stages and types of reduction produced in particular places can be determined, and sometimes even the form of artifacts imported or exported from a locus may be evident.

Technological Analysis of Debitage

Debitage is by far the largest artifact assemblage, both numerically and by weight, recovered from 26Ek5040, and that made of local chert comprises the vast majority. Of the local cherts, the variously colored altered basalts have been distinguished from the light colored altered tuffs, but the former contribute only about 3 percent of the material recovered; other raw materials comprise even smaller quantities and of these, only obsidian is described (Table 27).

Table 27. Total Debitage Samples and Counts.

	Samples	Counts
Tosawihi Altered Tuff	318	49159
Tosawihi Altered Basalt	100	1469
Basalt	16	22
Tuff	2	7
Andesite	4	5
Obsidian	142	168
Exotic Chert	2	2
Total	584	50832

As described in Chapter 2, in the technological analysis of debitage, each lot (the sample of a particular raw material from each provenience) was analyzed separately and the proportions of diagnostic flake types representing core reduction, blank preparation/edge preparation, early biface thinning, late biface thinning, and retouch/finishing reduction stages were characterized as *absent, rare, common,* or *dominant* in the sample. Just under 50,000 pieces of debitage from 443 lots were analyzed using this system. A relatively small number of flakes (n=141) pulled from miscataloged lots were not incorporated in the analysis. The system was designed primarily to describe biface reduction activities, which comprise the dominant technological industry during the whole of the Archaic at Tosawihi and in much of the surrounding region. Three types of data are produced using this technique: the number of samples of each material which contain each reduction stage, the relative frequency of that stage in each sample and in the assemblage as a whole, and the components of the reduction sequence in a given locus for a given material.

Summary results of the technological analysis appear in Table 28. This summary presents only the relative proportions of reduction activities represented in the assemblage as a whole, and declines to describe the combinations of activities in individual lots; that is, to address how much of the reduction sequence is represented in a given location.

Table 28. Results of Technological Analysis.

	Basalt		Chert		Exotic Chert		Obsidian		Opalite			
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Total Count	Total Percent
Debitage Samples with Core Reduction												
Absent	16	84.21	76	80.00	2	100.00	126	89.36	115	62.16	336	76.02
Rare	0	0.00	12	12.63	0	0.00	0	0.00	64	34.59	76	17.19
Common	0	0.00	5	5.26	0	0.00	0	0.00	6	3.24	11	2.49
Dominant	3	15.79	2	2.10	0	0.00	15	10.64	0	0.00	20	4.52
Total	19	100.00	95	100.00	2	100.00	141	100.00	185	100.00	442	100.00
Debitage Samples with Blank Preparation/Edge Preparation												
Absent	16	84.21	51	53.68	2	100.00	133	94.33	39	21.08	241	54.52
Rare	0	0.00	20	21.05	0	0.00	0	0.00	100	54.05	120	27.15
Common	0	0.00	20	21.05	0	0.00	0	0.00	42	22.70	62	14.03
Dominant	3	15.79	4	4.21	0	0.00	8	5.67	4	2.16	19	4.30
Total	19	100.00	95	100.00	2	100.00	141	100.00	185	100.00	442	100.00
Debitage Samples with Early Biface Thinning												
Absent	19	100.00	63	66.32	2	100.00	138	97.87	19	10.27	241	54.52
Rare	0	0.00	18	18.95	0	0.00	0	0.00	38	20.54	56	12.67
Common	0	0.00	11	11.58	0	0.00	0	0.00	97	52.43	108	24.43
Dominant	0	0.00	3	3.16	0	0.00	3	2.13	31	16.76	37	8.37
Total	19	100.00	95	100.00	2	100.00	141	100.00	185	100.00	442	100.00
Debitage Samples with Late Biface Thinning												
Absent	19	100.00	63	66.32	0	0.00	122	86.53	7	3.78	211	47.74
Rare	0	0.00	14	14.74	0	0.00	1	0.71	65	35.13	80	18.10
Common	0	0.00	14	14.74	0	0.00	4	2.84	76	41.08	94	21.27
Dominant	0	0.00	4	4.21	2	100.00	14	9.93	37	20.00	57	12.90
Total	19	100.00	95	100.00	2	100.00	141	100.00	185	100.00	442	100.00
Debitage Samples with Retouch/Finishing												
Absent	19	100.00	61	64.21	2	100.00	93	65.96	54	29.19	229	51.92
Rare	0	0.00	19	20.00	0	0.00	0	0.00	108	58.38	127	28.67
Common	0	0.00	10	10.53	0	0.00	3	2.13	22	11.89	35	7.90
Dominant	0	0.00	5	5.26	0	0.00	45	31.91	1	0.54	51	11.51
Total	19	100.00	95	100.00	2	100.00	141	100.00	185	100.00	442	100.00

For the assemblage as a whole (all materials combined), late biface thinning appears in the greatest number of samples; core reduction is least represented. Late biface thinning and retouch are *dominant* in more samples than other reduction stages, but the high retouch figure is influenced by numerous obsidian samples which contain a single pressure flake, and in which the stage represented by a single diagnostic flake is considered to dominate the sample. Early biface thinning is the most represented stage of the *common* measures, while blank/edge preparation and retouch/finishing stages are more often *rare* in a sample than other reduction stages. Thus, the middle stages of biface reduction dominate most of the assemblage as a whole, suggesting that bifaces were imported to the site partially finished and were exported before they were finished by pressure flaking.

When reduction stages are considered by debitage raw material, retouch/finishing is most often represented in the obsidian samples, edge/blank preparation is the most frequent stage represented among the colored Tosawihi chert samples, while Tosawihi opalite samples most often contain early and late biface thinning stages (Table 29).

Table 29. Proportion of Debitage Samples Containing Evidence of Reduction Stage.

	Colored Tosawihi Chert	Tosawihi Opalite	Obsidian
Core Reduction	20	37.9	10.7
Edge/Blank Preparation	46.3*	78.9	5.7
Early Biface Thinning	33.7	89.7*	2.1
Late Biface Thinning	33.7	96.2*	13.6
Retouch/Finishing	35.8	70.8	34.1*

* indicates stage with highest proportion(s) within each material type

In the system we have devised for recording technological information, the relative proportions (*absent, rare, common, or dominant)* of each element in the reduction sequence (core reduction, blank/edge preparation, early biface thinning, late biface thinning, and retouch/refinishing) in any given sample are recorded. The raw data appear in Appendix J; here we summarize the combinations of stages present in samples. Several hundred combinations of elements are possible, and can be used to identify the parts of the reduction sequence appearing in a given sample.

In the present analysis, more than one hundred different combinations characterize reduction. A sample which contains, for example, equal proportions of core reduction, blank preparation, early biface thinning, late biface thinning and retouch/refinishing could indicate production of bifaces taken all the way through the reduction sequence, or a number of separate instances of different portions of the reduction sequence undertaken in the same spot on the ground. A sample containing equal proportions of core reduction and blank preparation, no early or late biface thinning, and rare retouch could, on the other hand, represent the production of prepared biface blanks and some projectile point or biface finishing or resharpening (two separate actions). Table 30 compares the number of reduction sequence elements, or parts of the reduction sequence in samples of local cherts. Obsidian has been excluded because so many samples contain only one piece.

Table 30. Number of Reduction Sequence Elements Represented in Debitage Samples.

	Colored Chert		Opalite			
	Frequency of Samples	Proportion of Samples	Frequency of Samples	Proportion of Samples	Total Frequency	Total Percent
Not Characterized	16	16.84	4	2.16	20	7.14
One Element	38	40.00	7	3.78	45	16.07
Two Elements	16	16.84	20	10.81	36	12.86
Three Elements	11	11.58	29	15.68	40	14.29
Four Elements	12	12.63	64	34.59	76	27.14
Five Elements	2	2.11	61	32.97	63	22.50
Total	95	100.00	185	100.00	280	100.00

Approximately half of all samples contain either four or five elements, nearly the entire reduction sequence. In most places, reduction through three or more continuous stages took place. This suggests that there was little spatial segregation of lithic reduction activity, or that activity was intense enough to produce several different reduction sequence episodes in the same place.

Comparing the frequency of reduction elements by numbers of samples (cf. Table 30), we see that fewer complete sequences are represented in the colored chert. Thirty-eight (40%) samples of colored chert contain only one element, while only seven opalite samples (4%) contain only one reduction element (Figure 36). This pattern probably reflects the smaller sample sizes of the colored chert assemblage. Each stage of the sequence is about equally represented in the colored chert samples containing only one element; core reduction is the least common element and blank/edge preparation is the most common.

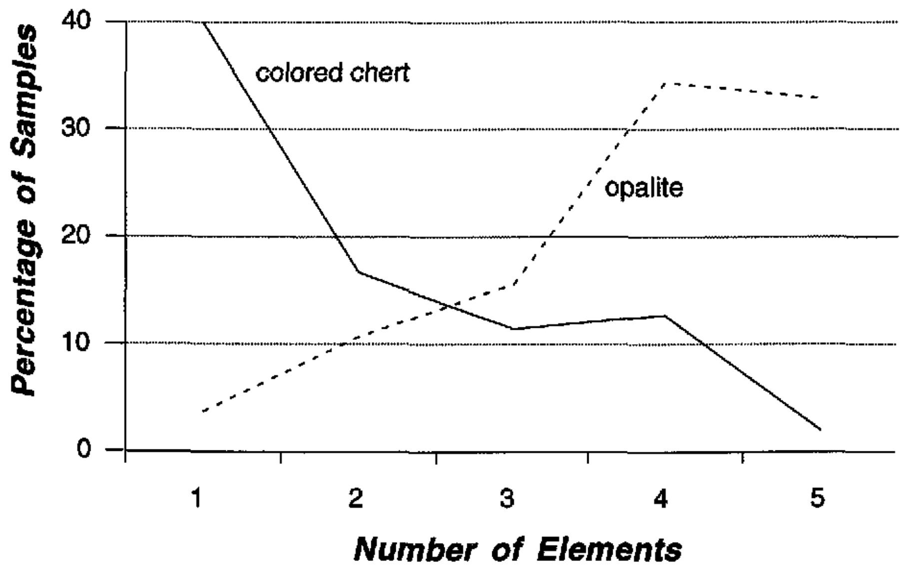

Figure 36. Comparison of opalite and colored chert reduction elements.

Eight point two percent of samples contain discontinuous sequences of reduction stages; that is, part of the sequence is missing and more than one event is represented. Discontinuous sequences are more common in colored chert samples (14.7%) than in opalite samples (4.9%). Chert reduction is a less important, less formal activity, smaller pieces are produced, and some flake core reduction may be present in addition to biface manufacture. In contrast, very few of the opalite samples either could not be characterized or contained only one element, reflecting in part the substantial sample size of most lots. As mentioned above, the element missing most often from the opalite is core reduction and since 68% of the samples contain either four or five elements, most of the reduction sequence, with the exception of core reduction, is present. Many samples could represent single reduction event scenarios in which a biface is reduced from Stage 2 to Stage 5. Alternatively, the samples could represent multiple reduction events.

Other Debitage Analyses

Several other types of variability in the debitage assemblage were also examined. Microdebitage analysis was conducted on soil samples from one feature and variation in the incidence of heat-treatment, size, and color were considered.

Microdebitage Analysis

The study of debitage too small to be recovered in standard excavation screens often has been used to identify locations of lithic reduction (Fladmark 1982; Metcalf and Heath 1990). Here, we used it to identify the nature of reduction, relying on the same flake morphologies observed in macrodebitage. Two samples of microdebitage were analyzed from Unit Q8 (cf. Chapter 3), collected from two levels where high densities of very small flakes which would have escaped 1/4 in. mesh were encountered. Examination of microdebitage identified a heat-treatment hearth at site 26Ek3092 (Leach, Dugas, and Elston 1992:385; Ataman and Bloomer 1990) in our previous excavations at Tosawihi. When overheating of opalite occurs, the bifaces, flakes, or blocks being heated may disintegrate, leaving only small angular fragments and potlids. When only slightly overheated, small pieces may be detached from thin edges. Over-heated objects may disintegrate upon subsequent reduction (the frequency and locations of bifaces whose failure is due to overheating are described in Chapters 3 and 4). Small to very small size debitage is continuously produced at every stage of reduction. Small flakes may move up and down in the soil matrix. In relatively flat areas such as Block Q they are unlikely to have moved horizontally from the location of primary deposition. Moreover, it is unlikely that either in the case of a heat-treatment hearth or the location of reduction that the small flakes produced would be moved by deliberate human agency to another location.

The samples recovered from Levels 4 and 5 of Unit Q8 were screened through 4 millimeter, 2 millimeter, 1 millimeter, and 500 micron mesh, and the debitage sorted from gravels and vegetable material (Table 31). The samples from each screen size were examined separately and none showed evidence of failed heat treatment. The <4 millimeter samples contain several flake types, including blank/edge preparation, late biface thinning, and retouch flakes; the 2 millimeter and 1 millimeter samples contain a few examples of retouch flakes, but most were not diagnostic to stage; and pieces from the 500 micron samples were too small to identify macroscopically.

Table 31. Microdebitage Analysis Sample Components.

Sample Q8-4-2-1 Original Sample Weight 5200g Sorted Sample Weight 457g

Mesh Size	Flakes weight	Flakes count	Obsidian Count	Gravel Weight	Rootlets
4 mm	31.1	91		206.6	
2 mm	3.3	106	2	73.5	
1 mm	2.5	270	5	134.8	
500 microns	0.1	43		3.9	
<500 microns					1.3
Total	37	510	7	418.8	1.3

Sample Q8-5-2-1 Original Sample Weight = 4600g Sorted Sample Weight=597.4

Mesh Size	Flakes weight	Flakes count	Obsidian Count	Gravel Weight	Rootlets
4 mm	23.6	90	1 (mahogany)	308	
2 mm	6.1	265	1	192	
1 mm	1.1	311		177.8	
500 microns	0.1	56	3	106	
<500 microns				121.6	
Total	30.9	722	5	905.4	

A number of pieces of obsidian and various colors of local chert were recovered from both samples, indicating that the lithic reduction activity represented consisted of more than one reduction event.

Heat-treatment

The heat-treatment of bifaces was discussed in Chapter 4, where it is explained that about 75% of bifaces exhibited signs of heat-treatment. The amount of heat-treatment in the debitage assemblage was used in Chapter 3 to examine the integrity of stratigraphic deposits. Samples of debitage were scanned and rough percentages of heat-treated material from each lot noted. Some tools, especially projectile points, are heat-treated during manufacture, others are made on heat-treated by-products of biface manufacture. The mean percentage of heat-treated debitage in a sample is 68.67%, which is quite high. We conclude that most bifaces processed at 26Ek5040 were heat-treated before transport to the site or at the site itself. Although a large number of debitage samples contained burned flakes (brush fires can cause the discoloration of flakes but successful heat-treatment rarely burns the exterior of a treated artifact), and a number of heat-failed bifaces were recorded, no evidence of heat-treatment hearths was found.

Size Grading

Samples of opalite debitage were size graded to assist in the stratigraphic analysis. Samples were passed through graded screens of 2 in., 1 in., 1/2 in., 1/4 in., and 1/8 inch mesh, and each sample was counted and weighed. This allowed examination of quantities and sizes of debitage which could be used in conjunction with technological and color analysis to evaluate integrity of deposits. (cf. Chapter 3).

Color

The proportion of colored debitage (that is, neither white, nor grey, nor beige) was estimated for each debitage sample (altered basalt and altered tuff samples combined). These were used in conjunction with size grade data and technological data to evaluate integrity of deposits (cf. Chapter 3).

Cores and Modified Chunks

Cores and modified chunks inform about the nature of lithic production. Our analysis defined cores as blocks of stone reduced to produce flakes rather than to transform the block into a tool. We defined modified chunks as minimally modified pieces which may represent either tested cobbles (pieces from which a few flakes were removed to test the workability of the stone) or as by-products of such an early stage of biface reduction that they are not clearly recognizable as bifaces. Some cores in the assemblage could be classed as patterned cores, that is blocks of stone (cobbles, chunks, pebbles, tabular pieces) from which several flakes have been removed in an organized fashion. Most patterned cores also exhibit prepared platforms created by intentional flake removals.

Seven cores and 16 modified chunks were recovered from the site (Figures 37, 38). Four of the cores are made of light colored opalite, one of altered basalt, one of basalt, and one of obsidian. Most have multiple irregular platforms, but the basalt core is a single platform split cobble example. Only the basalt core is made on a cobble.

Because both cores and modified chunks probably were discarded in the place where they last were used, they can inform about location of lithic production. The presence of cores and modified chunks on a site indicates that tool blanks, and perhaps tools, were produced there. At 26Ek5040, only one (an obsidian example) of the 23 was made of material imported from outside the project area.

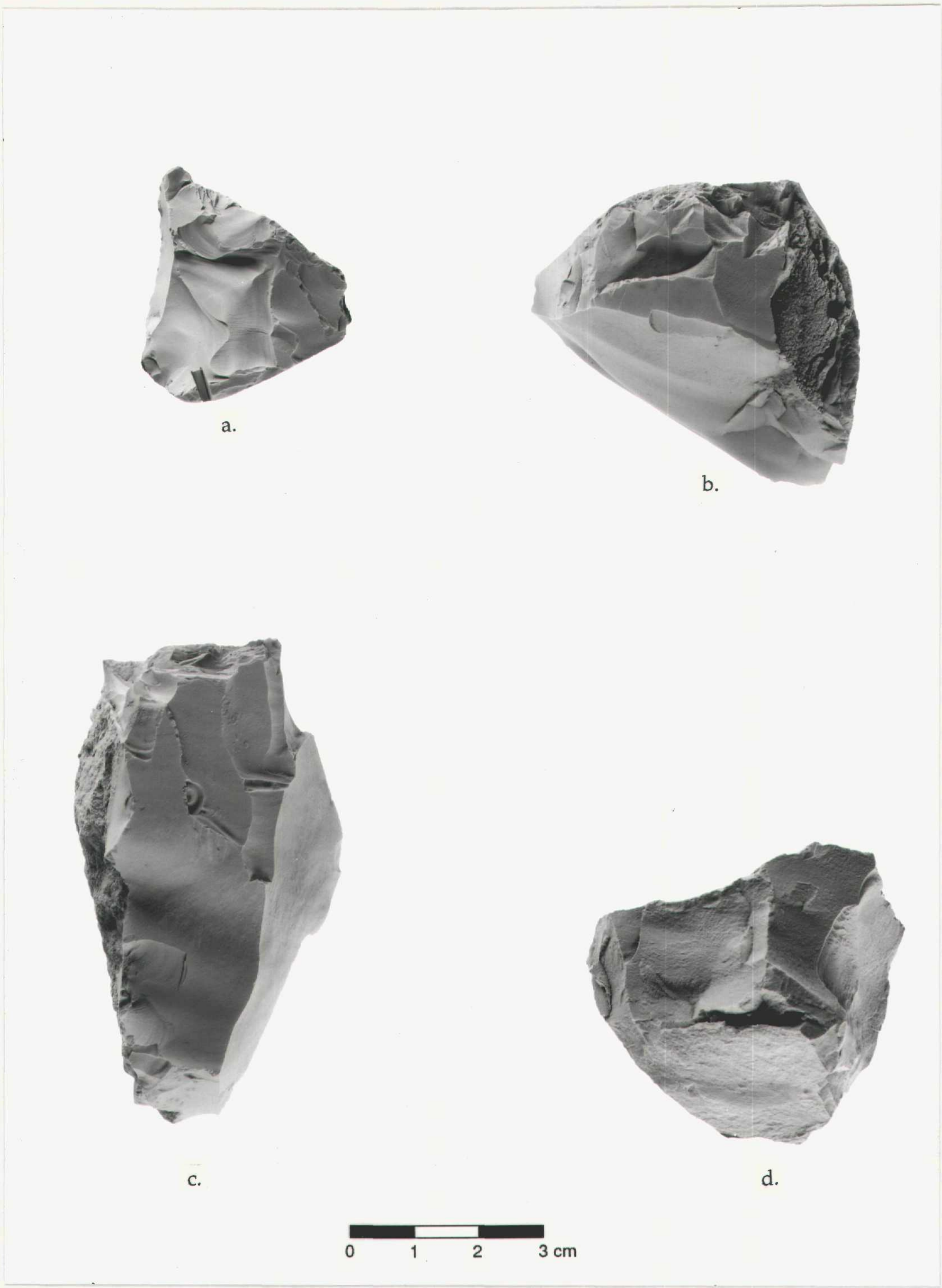

Figure 37. Selected cores.

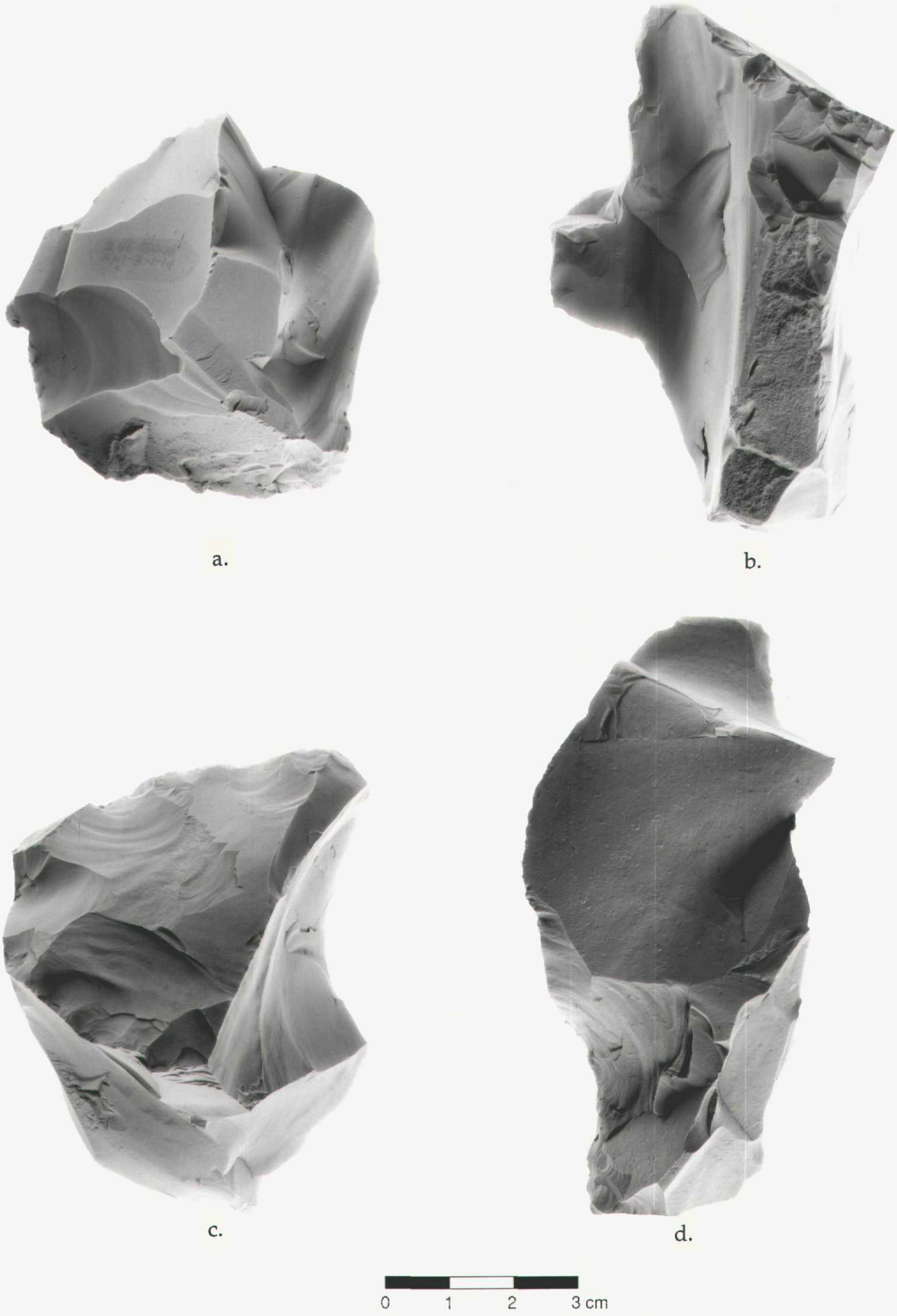

Figure 38. Selected modified chunks.

The extremely small number of cores recovered from this site reinforces our impression that most tool production at 26Ek5040 involved biface manufacture and that bifaces arrived at the site partially finished. It is unclear what the cores at this site were used to produce, but flake tools and projectile points are most likely. The modified chunks probably represent early stages of biface production; both cores and chunks are used to indicate manufacturing loci on the site.

Trajectories

Differences between tool form, methods of production, degree of reduction, and utilization are evident in the 26Ek5040 chipped stone assemblage. The following summarizes trends in tool production and use for each of the major raw materials represented, as can be determined from the tool and debitage analyses discussed above.

Obsidian

Obsidian samples were treated differently from samples of other raw materials in our analysis: surface debitage was collected as isolates and many specimens were recorded as individual pieces rather than in lots because so little obsidian was recovered. Nevertheless, most of the samples contained diagnostic flakes; of the 141 samples, only 51 could not be characterized. Core reduction, late biface thinning, and retouch are most strongly represented, while edge preparation and early thinning is much less common, suggesting that obsidian biface manufacture is rare at 26Ek5040 (in fact, only three obsidian bifaces were recovered). Tool finishing and/or reworking and the production of points on flakes removed from small cores were probably the most common obsidian reduction activities undertaken at 26Ek5040.

Tosawihi Altered Basalts

A much higher proportion (16 of 95 samples) of this colored material could not be characterized than was true of opalite samples, which are more numerous and usually larger. Only a minor amount of core reduction is apparent in the colored chert samples. The reduction stages represented are mostly blank production and thinning; blank/edge preparation is more common in these samples than in the light colored opalites. Bifaces are probably the intended product, but some flake production may also have been practiced.

Tosawihi Altered Tuffs

There were many more samples of this material than of any other and the samples were much larger. Only four of 185 samples could not be characterized. Few samples contained evidence of only one stage of reduction; 68% of samples evince either four or five of the five reduction stages. The one stage most often missing is core reduction. Retouch is a minor component of the samples; in most samples where retouch flakes are present, they are rare compared to other diagnostic flake types. Bifaces are the intended end product of opalite reduction at 26Ek5040. By-products of the process probably were used to produce smaller quantities of other tools (we have at least some evidence for opalite point manufacture), some of them expedient forms. The paucity of core reduction debitage and the abundance of biface reduction debitage and broken bifaces strongly suggests biface import for further reduction and, quite likely, heat-treatment on site. Some of these bifaces were used and broken on site, but most were exported in partially finished and finished form.

Summary

In addition to 'white' Tosawihi opalite, the prehistoric people who made bifaces at 26Ek5040 also used colored cherts from various Tosawihi sources and smaller quantities of obsidian, deriving from Paradise Valley located about 100 km to the northeast. Obsidian debitage was produced by reworking and rejuvenating tools brought to the site in finished form and by producing a small quantity of projectile points and other tools from small obsidian nodules transported to the site in cobble form. The debitage from colored cherts represents the reduction of bifaces which may have been brought on site in the form of flake blanks or partially reduced bifaces, but not as cores or chunks. Opalite debitage, which represents the vast majority of the artifactual assemblage at the site, is primarily the debris from biface production. The opalite bifaces were brought on site in partially finished form; partially finished and finished bifaces were exported for use elsewhere.

Chapter 6

26Ek5040 IN TIME, SPACE, AND THE TOSAWIHI PRODUCTION SPHERE

Kathryn Ataman

Insights into the prehistoric occupation of 26Ek5040 are most valuable for the comparative standards they provide, against which patterns of land use in the region of the Tosawihi Quarries can be observed. This chapter examines the chronology of 26Ek5040 and compares biface manufacture, toolstone exploitation, and obsidian trade with patterns observed elsewhere at Tosawihi (Elston and Raven 1992a; 1992b).

Site Chronology

A temporal context for 26Ek5040 derives from two radiocarbon dates, one tephra date, 19 typeable projectile points, and 45 obsidian hydration measurements. Comparable data from other Tosawihi sites are taken mainly from Elston and Drews (1992).

Stratigraphic Data

As described in Chapter 3, there is, near the base of the occupation debris at 26Ek5040, a layer of tephra or volcanic ash erupted from Mount Mazama (Crater Lake, Oregon) approximately 6900 years ago. Some cultural material is within and below this ash deposit. While this cultural material is slightly different in composition from material directly above the ash, with lower than average percentages of heat-treated debitage and higher percentages of colored debitage (cf. Chapter 3), natural mixing of deposits renders it impossible to determine if this material represents a pre-Mazama occupation of 26Ek5040. Soil from a stratum above the Mazama ash yielded a date of 4380 ± 200 years B.P. (cf. Figure 17). This stratum does not appear everywhere on site, but it allows assessment of the antiquity of those areas where it is observed. Charcoal from a hearth discovered in the north wall of Trench C, just below the present surface and extending to 15-20 cm below surface, has provided a date of 850 ± 200 years. Although these data-yielding strata are superimposed in some places, as attested by artifactual data, the occupational phases do not overlie one another as neatly as the proverbial archaeological "layer cake".

Temporally Diagnostic Artifacts

The nineteen projectile points recovered from 1992 and 1994 excavations date primarily to the Middle Archaic (5000 B.P.-1300 B.P.); two incomplete points may possibly represent the Late Archaic. Table 32 gives the vertical context of typeable points. In most cases, Level 1 contains the first 4 cm of soil, Level 2 extends 4-10 cm below the surface, and subsequent levels each represent 10 cm of deposit. Level 1 surface scrapes of 1992 removed 2 cm rather than 4 cm of fill. The quantity and distribution of point types in the deposits suggest that both mixing and deflation occurred.

Obsidian hydration measurements offer a relative measure of age; thin hydration rinds are younger and thick rinds are older. The hydrogen absorption rate varies with chemical composition of the material. Most (35 of 49 samples) of the analyzed obsidian from 26Ek5040 derives from the Paradise Valley source, one of the closest major sources to Tosawihi (Appendix A).

Table 32. Level Context and Time Frames for Projectile Point Types.

Type	Time Frame	Surface	Level Context Level 1	Level 2	Level 4	Level 5	Total
Gatecliff	(5000 B.P.-3300 B.P.)	5		1			6
Elko Series	(3300 BP.-1300 B.P.)	4	2		2	1	9
Humboldt	(5000 B.P.-1300 B.P.)	2					2
Large Side-Notch	(Pre-700 B.P.)	1				1	2
Total		12	2	1	2	2	19

Expressed as a dot plot (Figure 39), two groups of hydration absorption measurements are evident, one consisting of narrow rinds between 1.0-1.7 microns and another between 4.4 and 6.7 microns. Three measurements (7.8-8.1 microns), could represent even earlier occupation. The data suggest that most obsidian samples are not recent. The data also suggest a temporal gap between the two main occupations represented by obsidian. Even though site sediments are turbated, the stratigraphic distribution of rind measurements supports a similar scenario. Most of the rind measurements between 1 and 2 microns were recovered from surface or near-surface, while those measuring 4 microns or more were recovered from both surface and subsurface contexts (Table 33), with subsurface samples slightly more common. This suggests that the bulk of the deposits are mixed but not recent, and are capped by a later occupation.

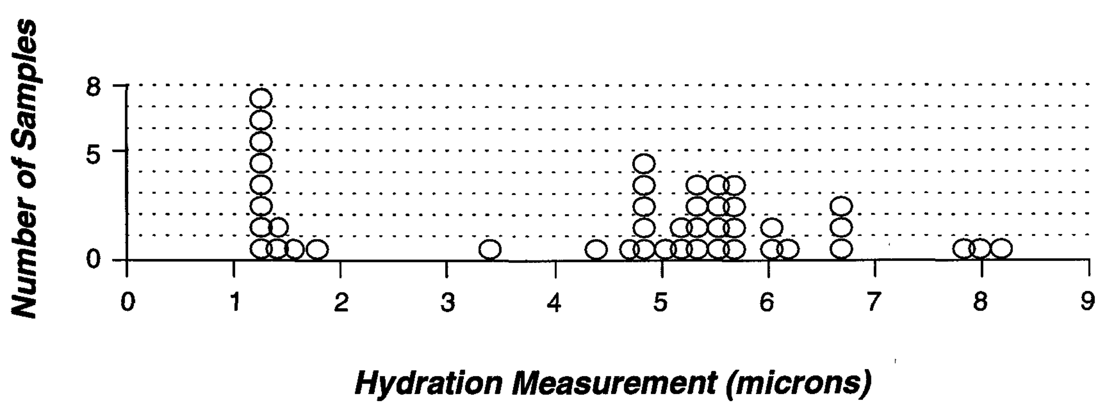

Figure 39. Dot plot of obsidian hydration measurements from 26Ek5040.

Table 33. Stratigraphic Context of Obsidian Hydration Measurements.

Rind Thickness (microns)	Surface	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Total
1-2 microns	7	3		2				12
3-4	1							1
4-5	2	1			2	3		8
5-6	4				3	6	2	15
6-7	3	1	1		1			6
7-8		1						1
8-9		1				1		2
Total	17	7	1	2	6	10	2	45

Artifact abundance in surface and subsurface contexts also suggests that while some deflation has occurred, subsurface deposits represent a significant portion of the occupation at 26Ek5040. Slightly more debitage, measured both by weight and count was recovered from levels below 4 cm than from the first 4 cm. When surface bifaces are discounted, the same pattern holds for biface weight (biface counts are very similar) (Table 34). This pattern is quite different from those of other non-quarry Tosawihi sites (Elston and Raven 1992a) and many other central Great Basin sites (e.g. Elston and Bullock 1994), where greatest artifact frequencies are close to the surface and deposition is shallow.

Table 34. Debitage and Biface Recovery, Surface and Subsurface Contexts.

	Surface (0-4 cm)	Level 1 (4-10 cm)	Subsurface (10+ cm)
Debitage weight	26,873	26,369	29,156
Debitage count	23,542	23,499	27,290
Biface weight	10,944	3,357	3,855
Biface Count	327	152	145

Three typeable obsidian points from 26Ek5040 exhibited readable hydration rinds. Two were Elko Series points with rinds of 4.4 microns and 6.1 microns, and one Large Side-notch/Northern Side-notch point has a rind of 4.8 microns. Obsidian points recovered elsewhere at Tosawihi are added to the sample (Table 35) for comparison of point types and mean hydration rinds. Both the typeable obsidian points and other tested obsidian from 26Ek5040 appear to (cf. Figure 15; Figure 40) predate the period represented by obsidian Elko and Gatecliff points from Tosawihi as a whole (c.f. Table 35).

Table 35. Mean Hydration Rinds for Tosawihi Point Types in Microns.

Point Type	Mean	Standard Deviation	Sample size
Desert	1.8	.65	22
Rosegate	2.9	1.3	5
Elko	4.3	1.0	8
Gatecliff	3.7	1.2	4
Humboldt	6.9	—	1
Large Side-Notch	4.1	2.1	4
Great Basin Stemmed	5.7	1.7	3

Using point type and hydration rind data from 26Ek5040, we can assume that the site represents multiple occupations, most of which probably date between about 4500 and 1300 years ago with an additional small component dating less than 1300 years ago (probably less than 700 years ago).

Our previous work at Tosawihi indicated that human use of the area began in the Pre-Archaic (Elston and Drews 1992) but its greatest use occurred in the Late Archaic, especially the latter half.

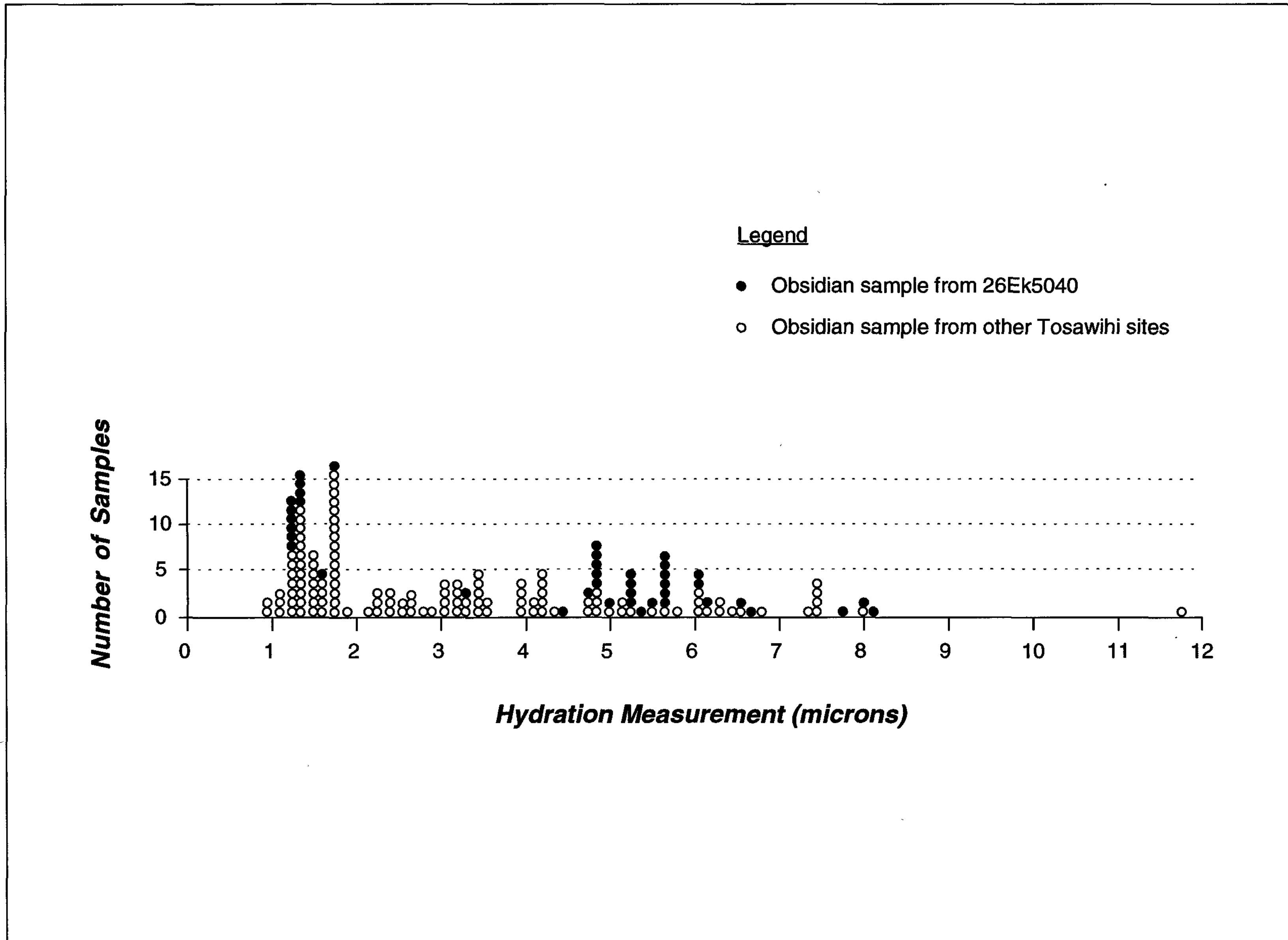

Figure 40. Dot plot of obsidian hydration measurements from Tosawihi sites.

Many Late Archaic sites also contain evidence of Middle Archaic occupation, but only four small sites with very small assemblages (26Ek3123, 26Ek3243, 26Ek3238, and 26Ek3516) appeared to be exclusively Middle Archaic (Elston and Drews 1992). The projectile point sample from 26Ek5040 is markedly different from the sample represented at other Tosawihi sites (Table 36), dating exclusively to the Middle Archaic.

Table 36. Comparative Point Type Proportions.

	26Ek5040		Other Tosawihi Sites	
	Frequency	Percent	Frequency	Percent
Desert		0.00	84	38.01
Rosegate		0.00	34	15.38
Elko	9	47.37	41	18.55
Gatecliff	6	31.58	20	9.05
Humboldt	2	10.53	13	5.88
Large Side-Notch	2	10.53	9	4.07
Stemmed		0.00	20	9.05
	19	100.00	221	100.00

Obsidian samples from the three areas of 26Ek5040 with the highest artifact densities show different rind thickness distributions (Figure 41). The samples from the northern ridge exhibit only very thin (1.0-1.7 microns) and very thick (6.0-8.1 microns) rinds. The southern ridge exhibits a mixed group of samples but includes very few thin rinds. The southern edge of the site, along the drainage on Terrace 1, contains primarily samples with thin rinds. These data suggest a scenario in which site occupation shifted from one area to another in time; the earliest occupation concentrated on the northern and central ridges; later, the densest occupation concentrated on the central ridge; and the very late surficial occupation occurred along the drainage on the south and on the high northern ridge.

The difference in temporal focus of occupation between 26Ek5040 and other Tosawihi sites we have studied raises questions about changes in technology, toolstone acquisition and extraction, subsistence, and so forth, which may have occurred between the Middle and Late Archaic and which could not be examined with the chronologically mixed data from previous excavations. Some of these questions can be addressed with data from 26Ek5040.

Patterns of Activity

Artifact distributions across the site are examined with an eye toward delimiting activity areas. We consider artifacts recovered by 1992 and 1994 excavations.

The highest densities of formed artifacts (cf. Figure 9) and debitage (Figure 42) occur along the high relatively flat surfaces of the three ridges running northwest/southeast where clusters of features occur (cf. Chapter 3). This distribution may have been affected somewhat by phases of deposition and erosion, but most soil movement during and since periods of occupation has been minimal and great horizontal movement of artifacts has been confined to areas immediately adjacent the drainages (cf. Chapter 3). It is likely that most of the human activity at this site occurred on the three relatively flat surfaces. Notwithstanding single event reduction features (see above and Figure 43), the material

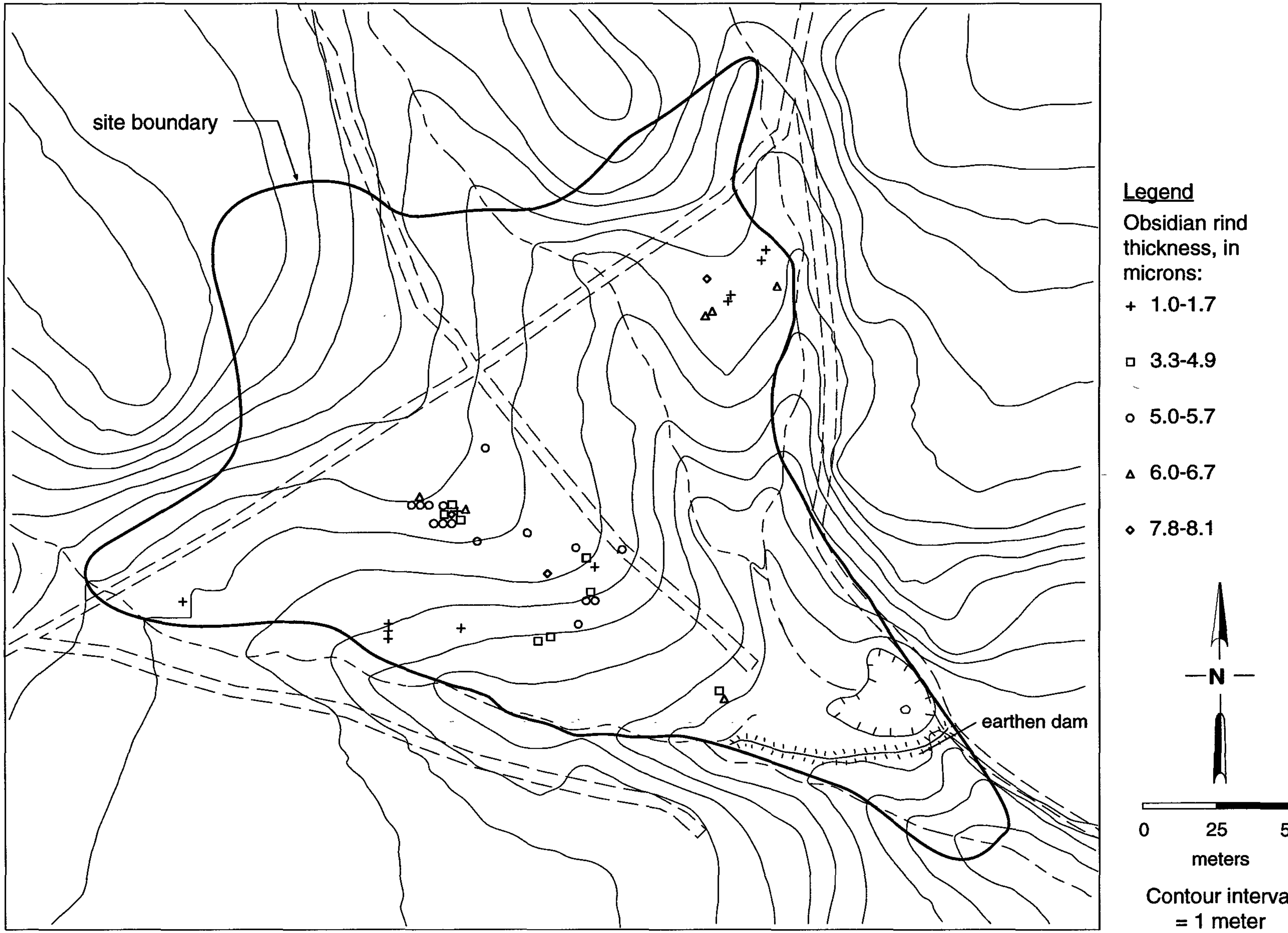

Figure 41. Horizontal distribution of obsidian hydration measurements at 26Ek5040.

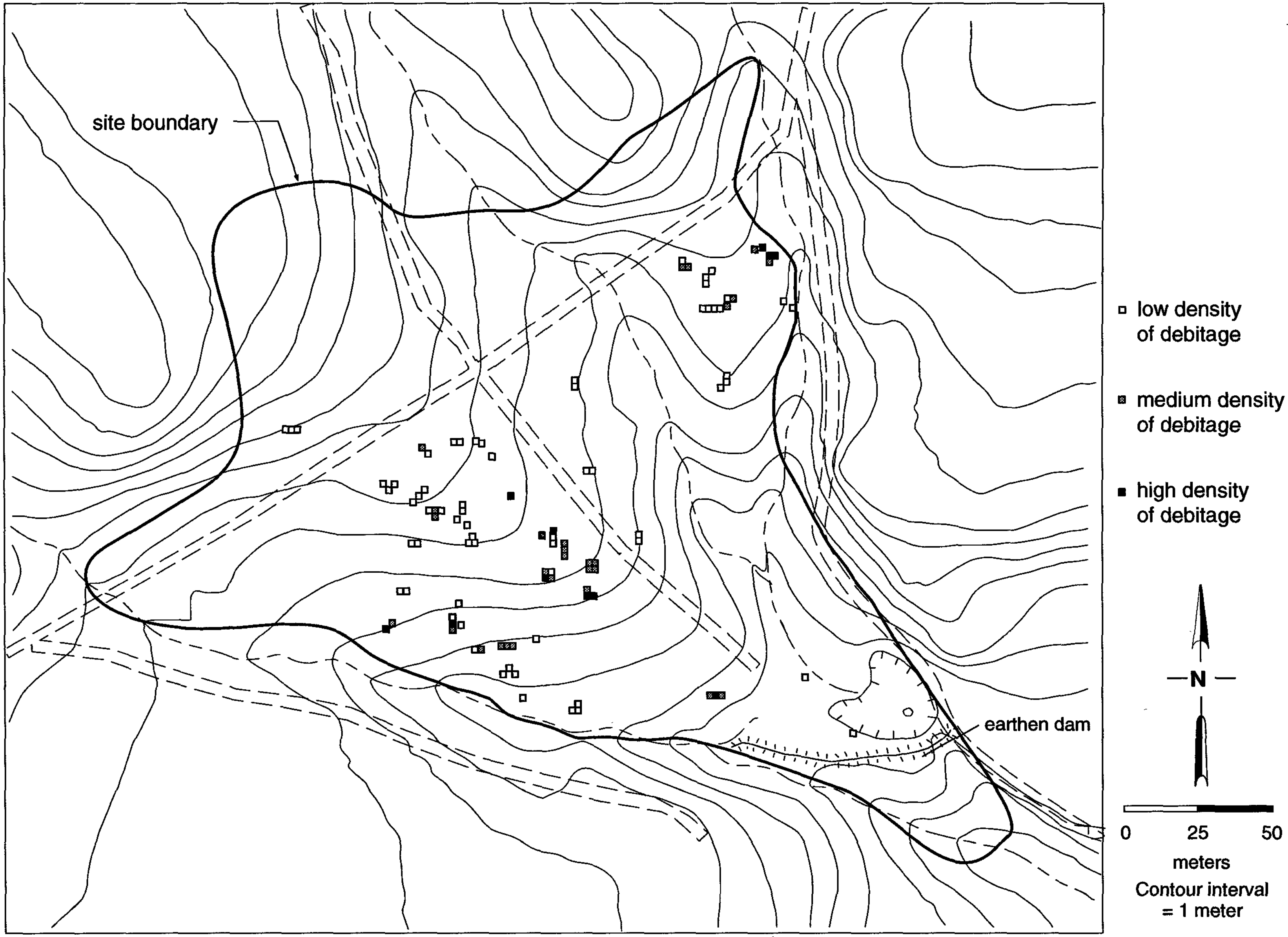

Figure 42. Density of debitage in 1992 and 1994 surface scrapes at 26Ek5040.

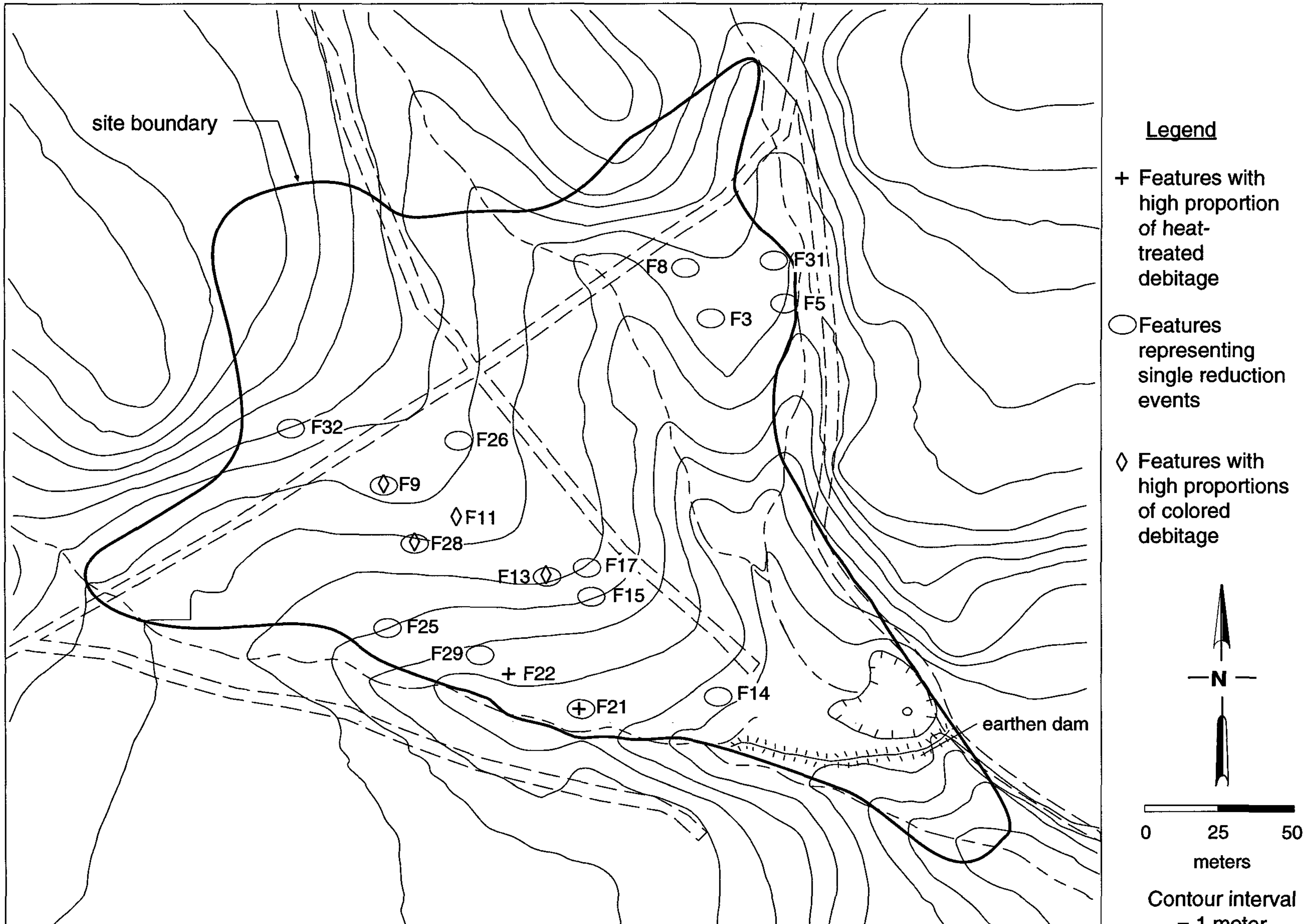

Figure 43. Characteristics of surface features at 26Ek5040.

on the present surface does not necessarily represent the latest occupation surface. Stratigraphic evidence for bioturbation and other post-depositional factors, as well as archaeological evidence (obsidian hydration and projectile point data), suggest that some surface material consists of mixed occupation debris.

Artifactual data recovered from the site suggest a number of activities which could have been undertaken. Individual features were described above; here we review the evidence for the site as a whole. High densities of debitage and broken tools (cf. Chapter 4) attest to lithic reduction. Groundstone and projectile point fragments evince food processing and consumption. Numerous flake tools indicate a variety of processing activities. The abundance of heat-treated debitage and broken tools, as well as heat-failed bifaces, suggests heat-treatment was common at the site.

Lithic Reduction

Lithic reduction at 26Ek5040 and at Tosawihi generally consists almost exclusively of biface manufacture. On-site evidence of biface reduction includes debitage, cores and modified chunks, hammerstones, and bifaces. Most bifaces were discarded due to breakage (cf. Chapter 4) and probably only late stage bifaces were discarded as a consequence of use failure rather than manufacturing failure. Bifaces are the most common formed artifact type recovered from the site; 474 were recovered in 1994 and 169 in 1992. The surface distribution of bifaces (Figure 44) reveals little more than the fact that lots of bifaces were produced in the same areas where most other activities took place.

If surface biface distribution is examined by reduction stage, we learn a little more; Figure 45 displays the distribution of early (Stage 2 and 3), middle (Stage 4), and late stage or nearly finished (Stage 5) bifaces. Early stage bifaces are found nearly everywhere, but three areas, on the northwestern extremes of the site and at its southeastern tip, have almost no other biface stages represented. Technological characterization of debitage from surface features in those areas reveals slightly more early stage debitage compared to other contexts and the bifaces recovered during feature excavation are primarily Early and Middle Stage 3, but the data are suggestive rather than definitive. Stage 5 bifaces appear to have been discarded most often in the areas where the widest range of other activities took place, along the southern margin of the central group of features and in the southern group of features, possibly indicating areas of biface use. Consideration of other indicators of lithic reduction activity are not very illuminating. The few hammerstones are also found on the central ridge, corresponding to the distribution of cores and modified chunks, where a variety of activities appears to have taken place (Figure 46).

As described above, some other characteristics of lithic reduction at 26Ek5040 reveal possible differences in site use (cf. Figure 43). The distribution of features which appear to be single reduction events is widespread, the distribution of features with high quantities of colored chert (as opposed to white opalite) is restricted to the center of the southern ridge, and the two features with the highest proportions of heat-treated debitage are along the southern edge of the site.

The distribution of obsidian is also patterned, as shown in Figure 46. The highest density is on the northern ridge, but a light scatter of obsidian is present over much of the site.

Projectile Point Manufacture, Reworking, Discard

Projectile point fragments and the debitage from point manufacture are morphologically distinctive. Projectile point fragment types in the absence of or in conjunction with debitage can be used to infer the location of point manufacture, reworking, game butchering and processing, and retooling (cf. Chapter 4). At 26Ek5040, evidence of point manufacturing is widespread across the site, but distributions of evidence for other point-related activity reveals no clear patterns (Figure 47).

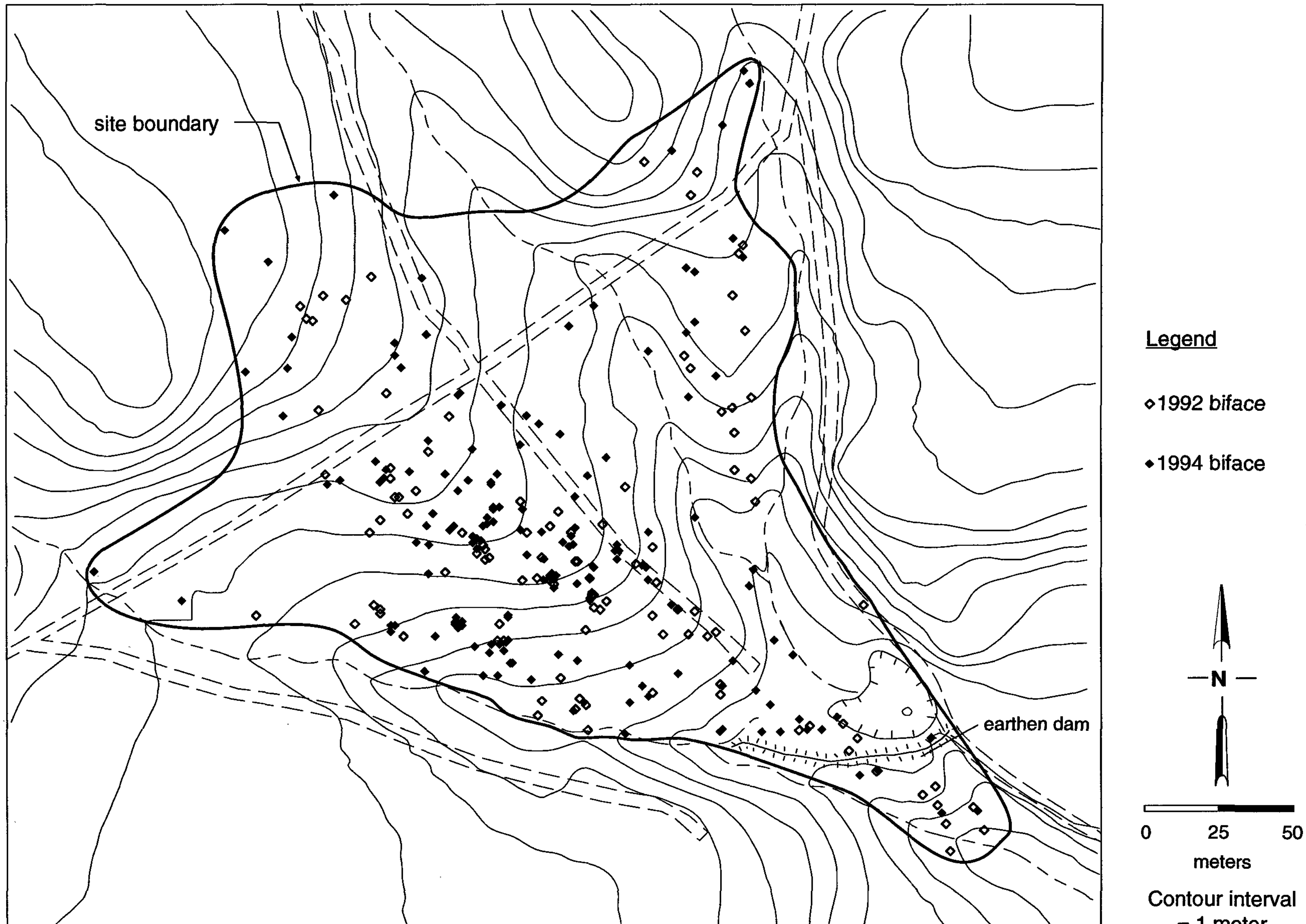

Figure 44. Surface distribution of bifaces at 26Ek5040.

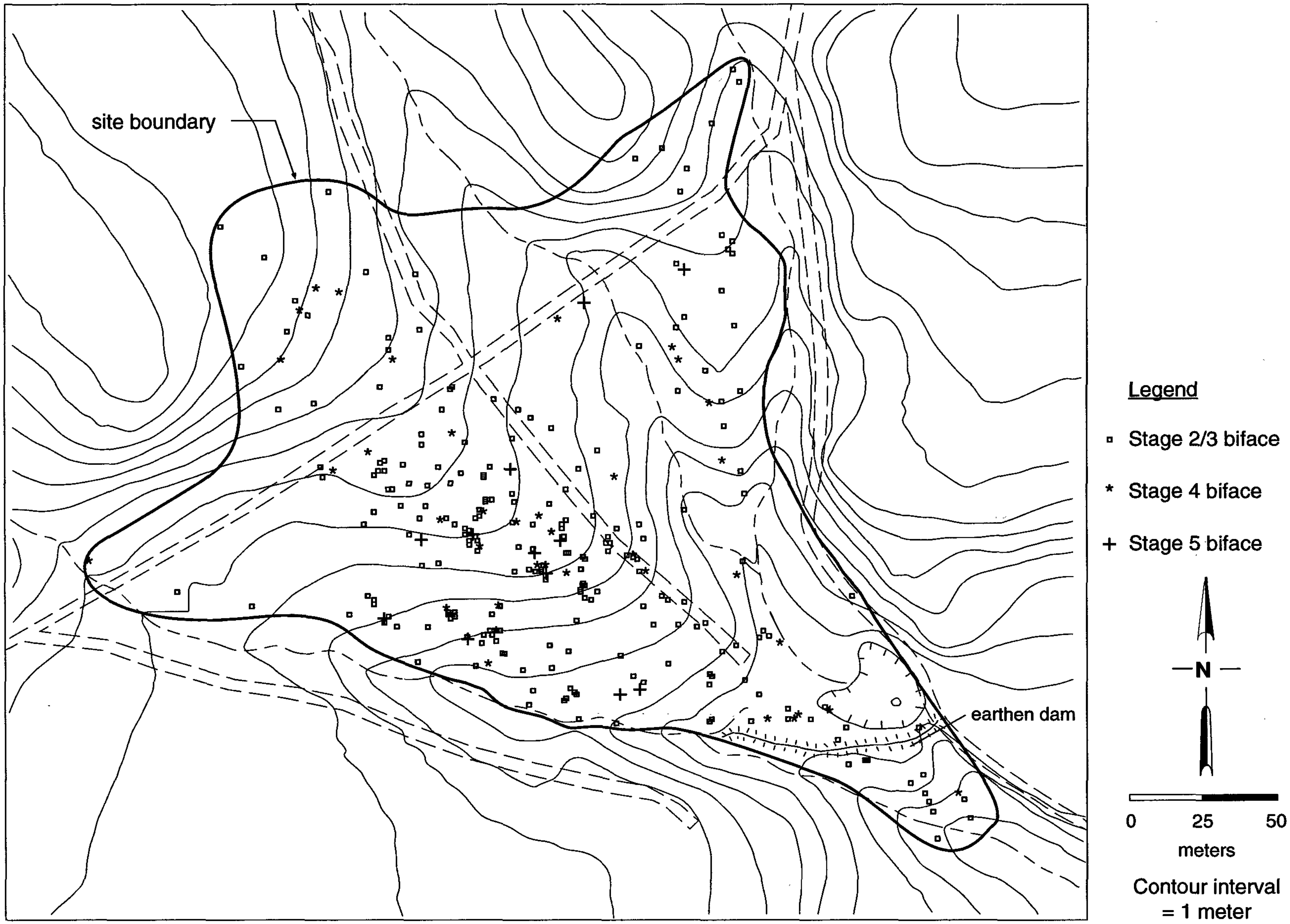

Figure 45. Biface distribution, by stage, at 26Ek5040.

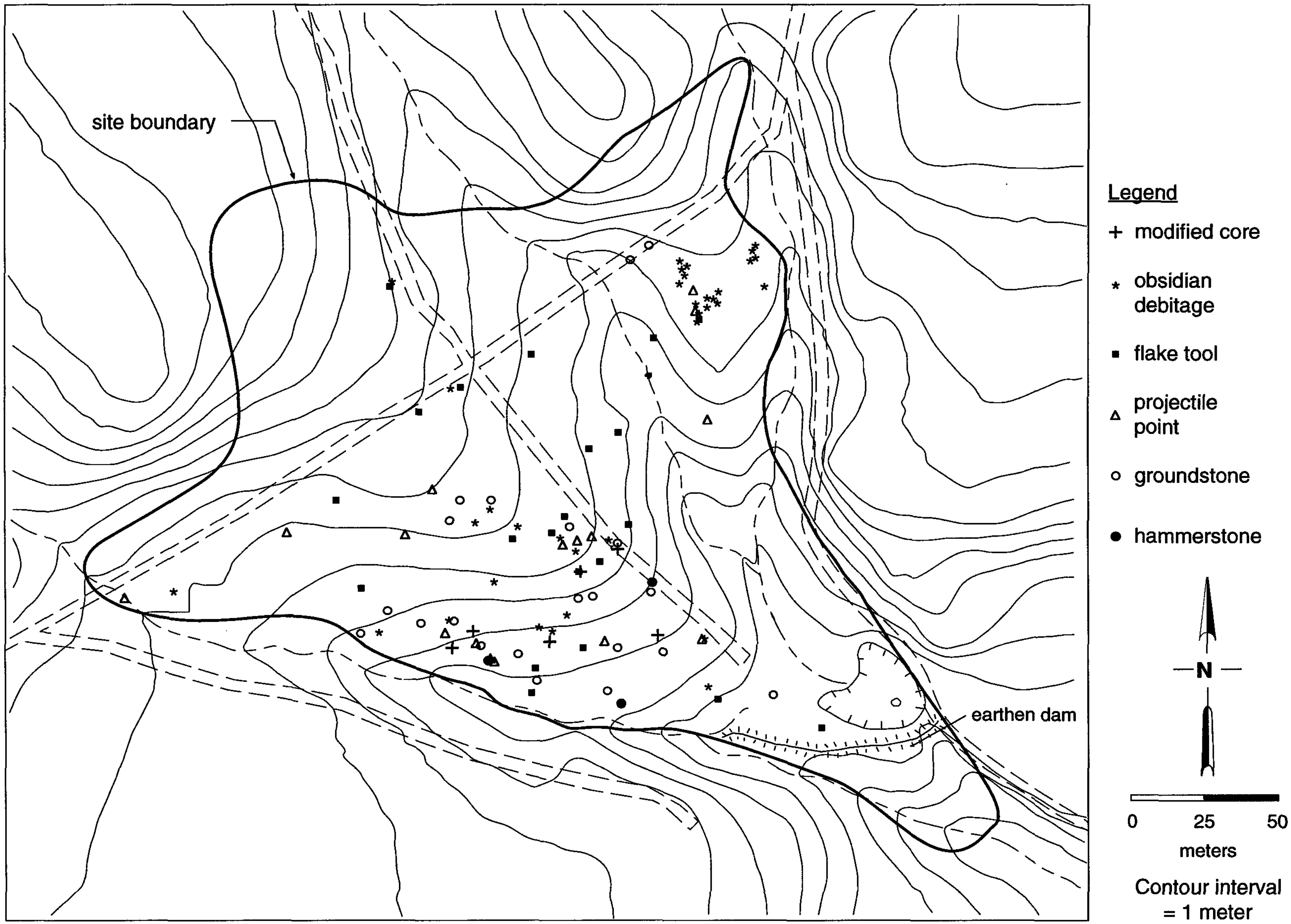

Figure 46. Surface distribution of artifact types at 26Ek5040.

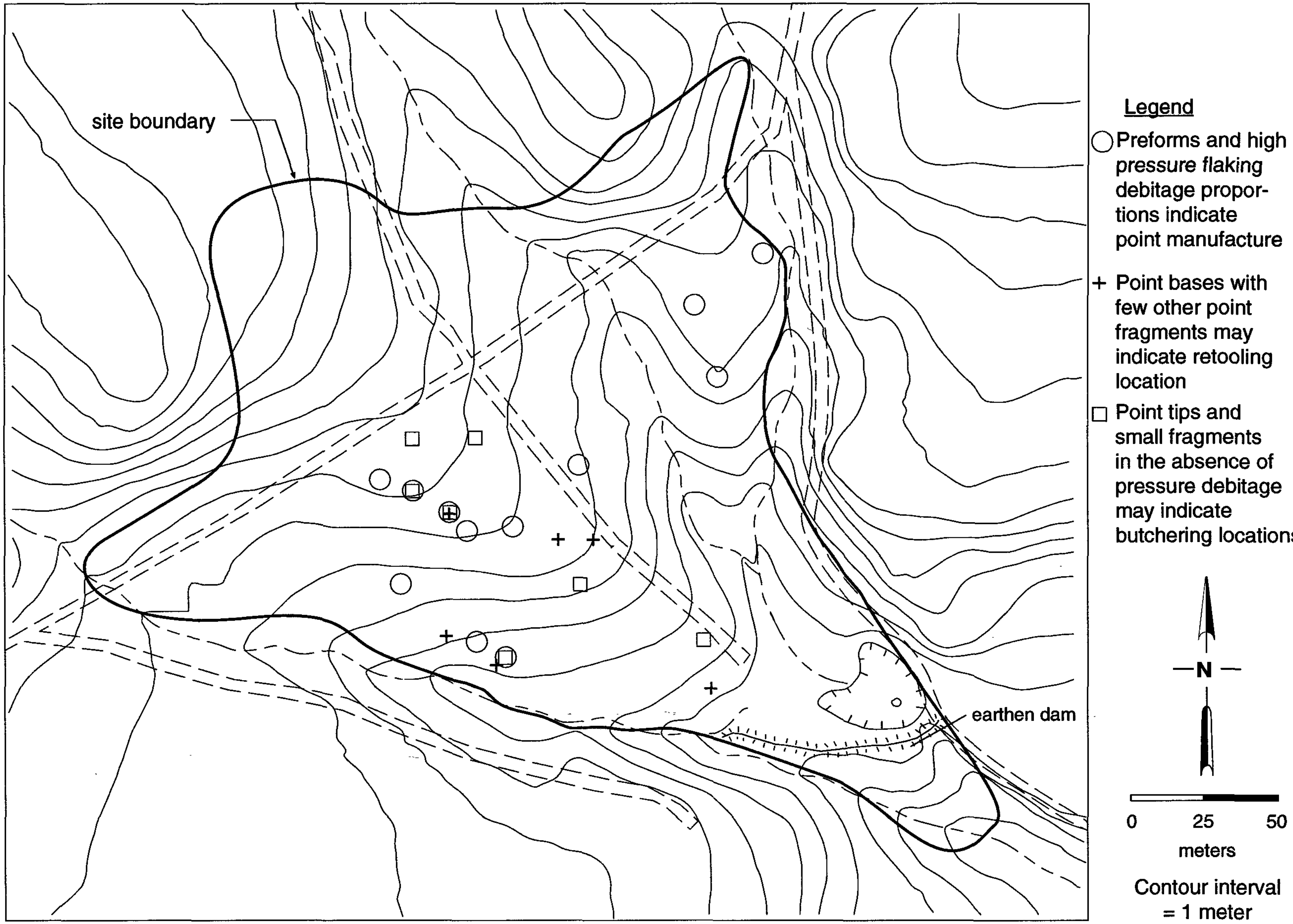

Figure 47. Projectile point manufacture and discard distribution at 26Ek5040.

Flake Tools

Although precise functions have not been proposed for the flake tools recovered from 26Ek5040, we presume these are implements for processing foodstuffs and other materials. Scrapers often are considered to be hide-processing tools, but other functions are possible; pointed tools could be applied to hide-processing, textile processing, or incising; notched and denticulated tools may be used as wood or plant processing tools; and bifacial flake tools are best suited to cutting tasks (Ataman 1992a). Flake tools are concentrated on the central ridge (Figure 48). This distribution suggests that activities identified in our analyses were located along the center of this ridge, the focus of site activity in almost all periods of occupation.

Hearths and Heat-Treatment Facilities

A high proportion of the bifaces and debitage recovered at 26Ek5040 were heat-treated (cf. Chapter 4). Because the site is located so close to a major opalite source and because in our experience at Tosawihi we have noted very little heat-treatment conducted at quarry sites (Bloomer, Ataman, and Ingbar 1992), we conclude that toolstone was brought to the site in unheated form and that bifaces were heat-treated there before their export from the site. The hearths and possible hearths revealed in excavations at 26Ek5040 which could have been used for heat-treating bifaces are all clustered at the northern end of the central ridge (Figure 49). This clustering may be a function of preservation since soils in this part of the site are deep and the surface is flat. This area is also where the heaviest concentration of other activities is observed. The features in Blocks AM and Q were those most likely to have been hearths (cf. Chapter 3), but the other possible hearth features are plausible, if rather disturbed.

Heat-treatment hearths may be recognized most easily by heat-treatment failure. When opalite is over-heated, it will fracture into angular fragments unlike those produced during biface reduction. Soil samples were collected from Block Q where large numbers of very tiny opalite flakes were observed in the soil matrix. The morphology of these flakes, however, did not suggest the presence of a heat-treatment hearth (cf. Chapter 5).

Quantities of heat-failed bifaces also can be possible indicators of in-situ heat-treatment. Heat-treatment is a risky process because temperature is difficult to control; over-heated bifaces are prone to failure (Ataman and Bloomer 1990). Over-heated bifaces are likely to be discarded near locations of heat-treatment, since the costs incurred in the transport of bifaces which may fail is unacceptably high (Elston 1992b). Most bifaces recovered at 26Ek5040 have been heat-treated (cf. Chapter 4); some (n=38) show evidence of failure due to over-heating. A concentration of heat-failed bifaces might suggest a locus of heat-treatment (i.e., a hearth), but heat-failed bifaces are widely distributed at 26Ek5040 (cf. Figure 49).

Considering the apparent intensity of activity at the site, and the degree of heat-treatment observed, it is likely that numerous hearths used during the occupation of the site, whether for heat-treatment or other purposes, have been so severely disturbed that no evidence remains.

Plant Processing

If groundstone is taken as an indicator of food processing, a relatively clear pattern of processing activity can be seen. Neither manos nor metates were found on the northern ridge. Most groundstone was recovered from the central ridge (cf. Figure 46) and the terrace below the ridge, along the major drainage on the site. When charged, this drainage may have supported economic plants to which the distribution of groundstone probably is related.

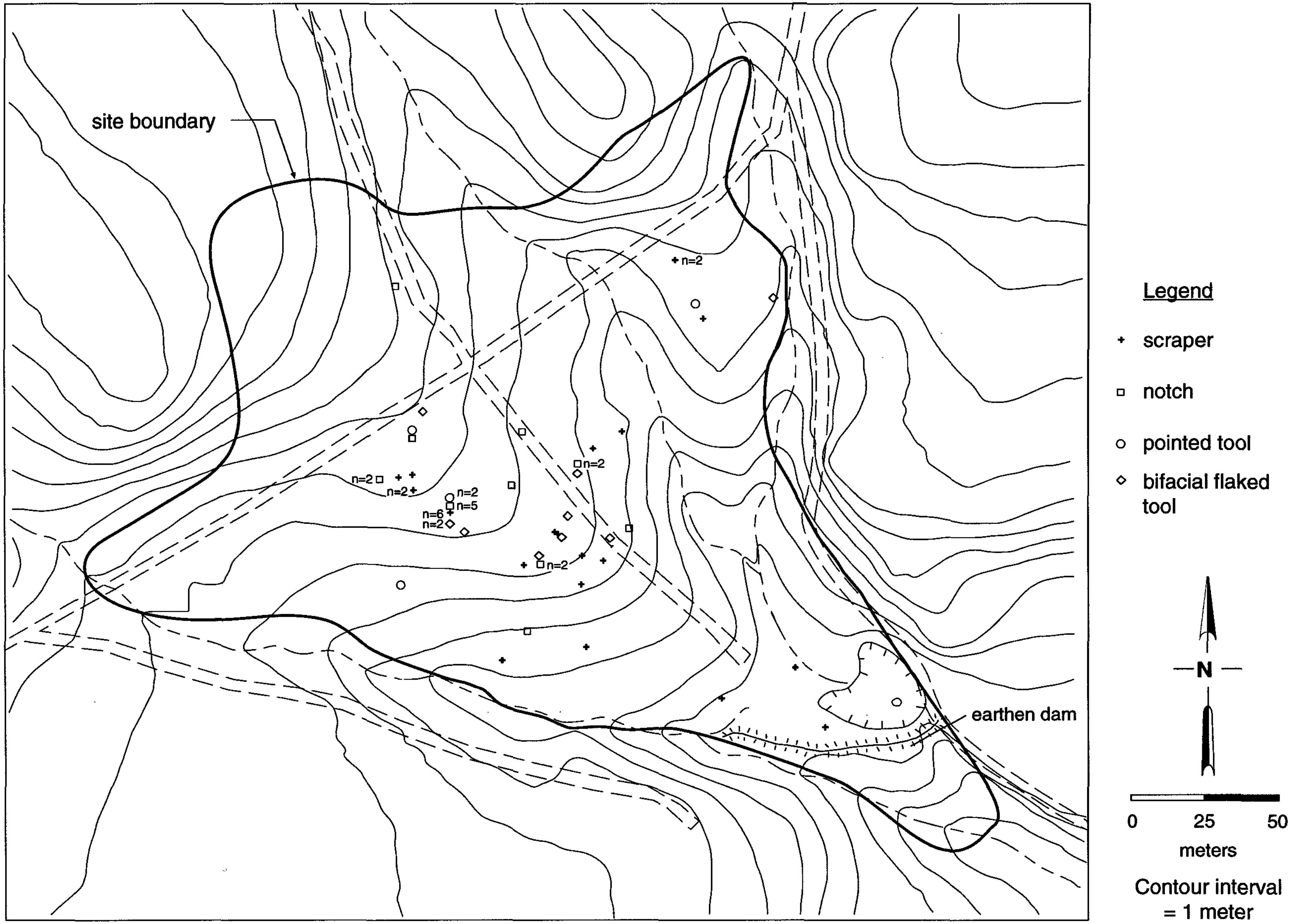

Figure 48. Surface and subsurface distribution of flake tool types at 26Ek5040.

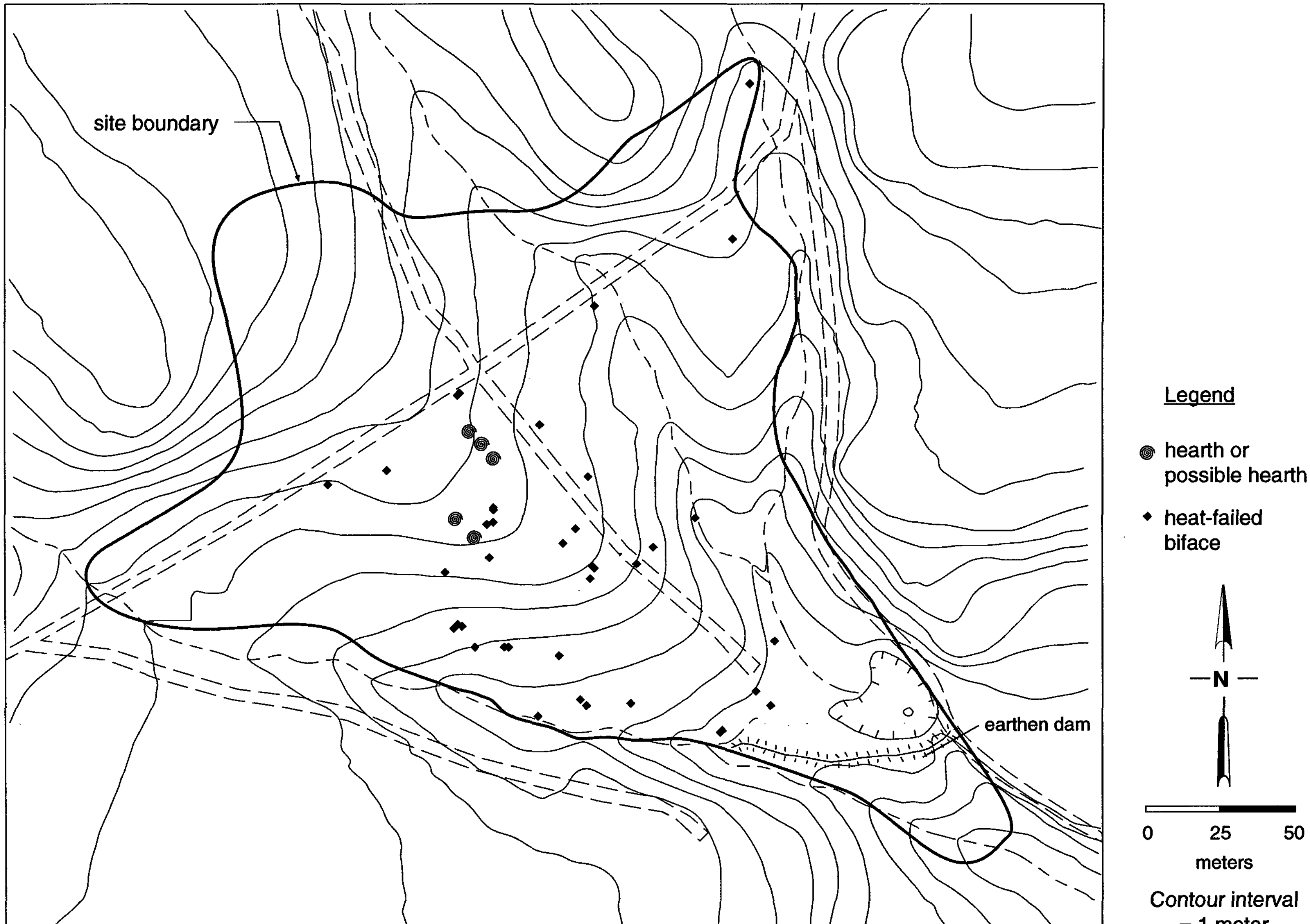

Figure 49. Distribution of hearths and heat-failed bifaces at 26Ek5040.

Biface Reduction and Temporal Change

The basic elements of biface manufacture in the Tosawihi region appear to remain the same during the whole of the Archaic; flake blanks, cobbles, and blocks are edged, thinned, heat-treated, further thinned, then finished. But details of manufacture and technique changed somewhat from the Middle Archaic occupation of 26Ek5040 and the Late Archaic intensification in use of Tosawihi Quarries.

Technologically, a slightly greater reliance on flake blanks is documented in the Middle Archaic, while the use of stream cobbles remained constant in both periods. The sequence of reduction remained similar from the Middle to the Late Archaic; in most cases, both sides of a biface were reduced equally through the reduction process. Heat-treatment was initiated during a wider range of stages at 26Ek5040, an indication of a less standardized approach to this phase of biface manufacture.

The biface assemblage at 26Ek5040 includes examples from a wide range of reduction stages (cf. Table 13); most other sites investigated at Tosawihi Quarries evince a more restricted range (Bloomer, Ataman, and Ingbar 1992:109; Figure 50). Again, this is evidence of reliance on less standardized biface manufacturing techniques and possibly more use of bifaces at Middle Archaic 26Ek5040 compared to other Tosawihi sites of the Late Archaic. At 26Ek5040, a greater number of near-finished bifaces and fewer early stage bifaces were recovered with correspondingly more heat-treatment than seen elsewhere at Tosawihi (Figure 51). The higher proportion of indeterminate stage bifaces in the 26Ek5040 assemblage is likely related to the greater proportion of later stage bifaces, which are more likely to break in manufacture.

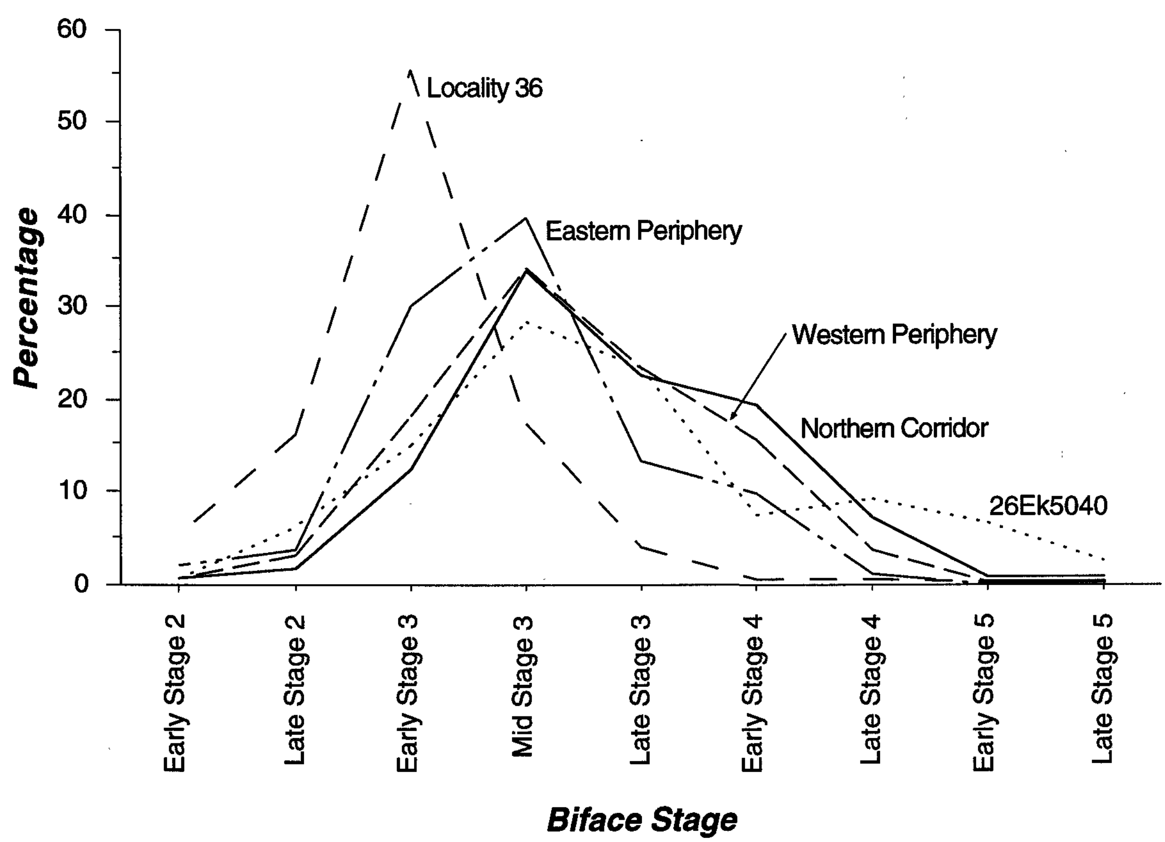

Figure 50. Biface stages in selected Tosawihi assemblages.

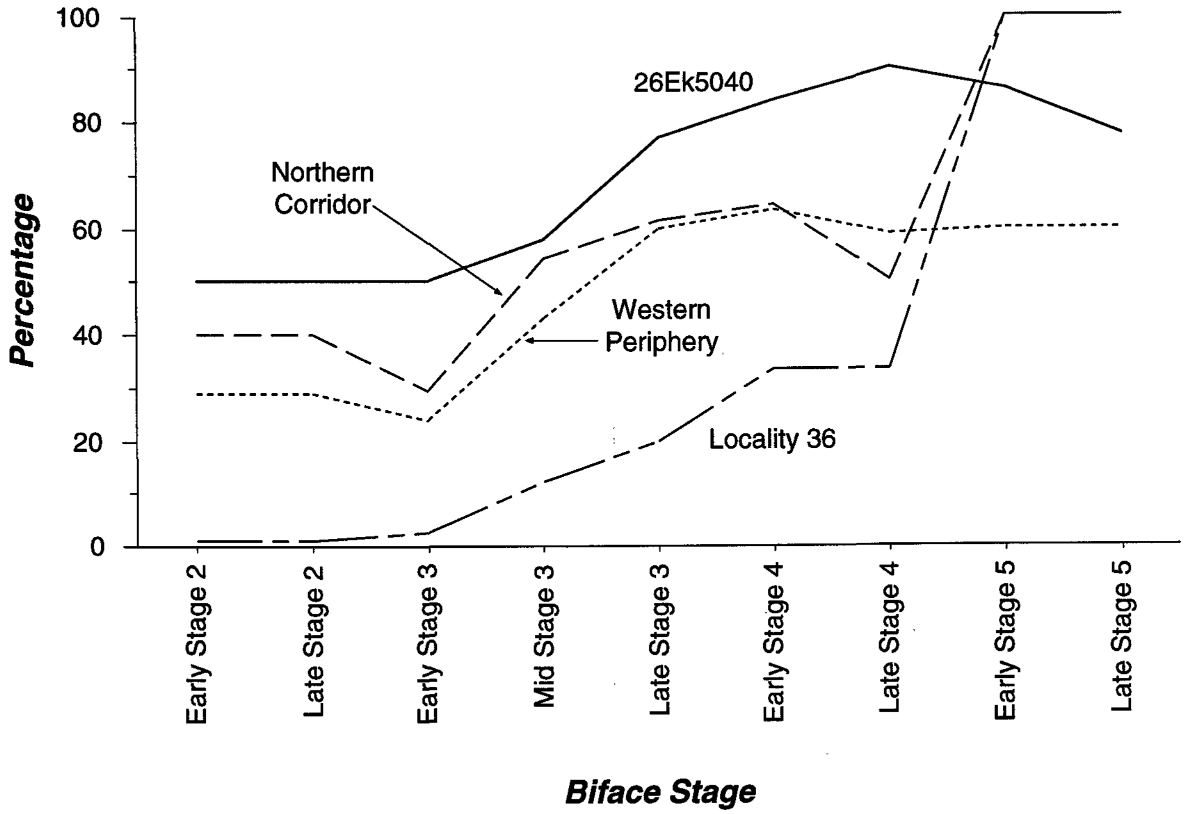

Figure 51. Heat-treated biface stages in selected Tosawihi assemblages.

Modeling biface export (Ataman and Botkin 1991; Ataman 1992b:100-102; cf. Chapter 4) revealed what may be the greatest difference in biface manufacture between the two time periods. At other Tosawihi sites, one half the bifaces were assumed exported at Middle Stage 3 and half in Late Stage 3 and Stage 4 (Ataman and Botkin 1991). At 26Ek5040, most bifaces appear to have left the site at Middle or Late Stage 3 (more in Late Stage 3), some in Stage 4, and some as finished tools.

In general, differences in biface manufacture between 26Ek5040 and other Tosawihi sites suggest that a less uniform approach to biface manufacture in the Middle Archaic gave way to a more rigid, standardized method of manufacture in the Late Archaic, and hint at a transition from a more residential to a more industrial use of the area.

26Ek5040 and the Tosawihi Distance Model

Tosawihi opalite was used widely in what is now north-central Nevada, between the north fork of the Humboldt and Iron Point. The relative proportion of debris from late stage lithic reduction as well as the proportion of heat-treated bifaces increases with distance from the center of the quarry complex, consistent with a model of toolstone procurement derived from economic behavior theory (Elston 1992b). The farthest distances at which opalite artifacts are reported suggests that some Tosawihi material no doubt was traded, but because opalite is found in quite large quantities many kilometers from Tosawihi, much of it probably was acquired though direct access to the quarries (Ataman and Bloomer 1992; Ataman and Ingbar 1994).

Tosawihi Quarries is an 800+ acre complex of quarry sites, peripheral to which is a complex of workshops and campsites encompassing an area of more than 125 square kilometers. Tosawihi opalite was extracted from outcrop quarries, adits, and subsurface quarry pits, providing high quality toolstone for at least 8000 years (Elston and Drews 1992; Elston and Raven 1992b). People came to Tosawihi to quarry toolstone, stayed to manufacture bifaces and to heat-treat them, and left taking middle stage bifaces with them; no evidence has appeared suggesting long term residential activity. Survey investigations (Leach and Botkin 1992) have defined a Tosawihi Production Sphere within which the major prehistoric activity during the whole of the Archaic was the processing of toolstone.

We compared groups of sites progressively distant from the center of the quarries to examine progressive reduction with distance. The groups, from closest to farthest, are the Quarries proper, the Eastern Periphery, the Western Periphery, and the Northern Corridor (Bloomer, Ataman, and Ingbar 1992; Ataman and Bloomer 1992). Locality 36, the only major quarry site which has been excavated, was used to represent the quarry group. Bifaces from sites close to the quarries were the least reduced, bifaces from sites far from the quarries were the most extensively reduced. Heat-treatment patterns were similar. This pattern must be influenced most by remains from the Late Archaic when use of the quarries was extensive. Such influence may have obscured any difference in the pattern from earlier times.

When proportions of bifaces in each reduction stage and proportions of heat-treated bifaces in each reduction stage from Site 26Ek5040 are compared to those from the four groups of sites, some differences are evident (cf. Figures 50, 51). Although Middle Stage 3 is the most frequent stage represented for all groups with the exception of Locality 36, the higher proportions of late stage bifaces and heat-treatment at 26Ek5040 suggest that the site may have experienced a higher degree of biface *use* than the other sites. High proportions of heat-treated bifaces in Stage 5 in the Western Periphery and the Northern Corridor are represented by extremely small samples.

Bifaces used at Tosawihi may have served primarily as knives (Ataman and Bloomer 1990), but use-wear analysis has provided some evidence for multiple functions (Bloomer, Ataman, and Ingbar 1992:100-101). Thus, greater biface use may signify either greater emphasis on cutting tasks, or use for more varied tasks, suggesting that periods of residence could have been longer or more intensive. This contrasts with interpretations of occupation at Tosawihi dominated by Late Archaic time-markers (Elston and Raven 1992a) when intensified quarrying was accomplished with short-term occupations of limited activity.

Obsidian and the Question of Trade and Access to the Quarries

Of the 179 pieces of obsidian recovered at 26Ek5040, 49 were characterized as to source; seven points and point fragments, two bifaces, and a core were examined in addition to debitage (Appendix A). Most of the 26Ek5040 material derives from the Paradise Valley source, 90 km northwest of Tosawihi, with a few samples deriving from Brown's Bench, Mount Majuba, and Pinto Peak/Double H Mountains. These sources were also identified in samples analyzed during previous work at Tosawihi (Table 37). Since the occupation of 26Ek5040 predates occupations represented in the bulk of analyzed obsidian samples from Tosawihi (cf. Figures 39, 41) patterns of obsidian source use at Tosawihi appear long-lived.

Table 37. Comparative Obsidian Source Characterizations.

	26Ek5040	Other Tosawihi Samples
Paradise Valley, NV	36	71
Brown's Bench, NV	3	37
Mount Majuba, NV	3	1
Pinto Peak/HH Mtns., NV	3	5
Timber Butte, ID	0	1
Bordwell Spring, NV	0	1
Malad, ID	0	3
Fox Mtn, NV	0	1
Unknown	4	26
Total	49	146

All the obsidian sources represented at Tosawihi are north of the Humboldt River (Figure 52). When obsidian source data from nearby sites are compared, a pattern emerges wherein sites located north of the Humboldt River contain obsidian derived only from obsidian sources north of the river, while sites south of the river contain obsidian derived from more sources which are located both north and south of the river (Dugas, Bullock, and Elston 1994; Ataman 1994).

An obsidian data set from the Middle Humboldt region exhibits a similar pattern to that seen at Tosawihi (A. Schroedl, personal communication, March 1995). Ongoing work in the Little Boulder Basin southeast of Tosawihi about 20 km, and just north of the Humboldt River, has sourced 118 samples, only two of which are south of the river. Obsidian source data south of the Humboldt was obtained from the Mule Canyon area, near Beowawe (Elston and Bullock 1994). There, the pattern of prehistoric obsidian source utilization is distinctly different from that observed from sites north of the Humboldt River; the 287 sourced pieces of Mule Canyon derive from a geographically wider group of sources which lie both north and south of the river (cf. Figure 52).

The economic model of behavior which has been used to describe the nature of opalite tool and debitage distribution (Elston 1992b) does not apply to the observed patterns of obsidian source use, because nearest sources are not always exploited. Numerous factors may affect obsidian source distribution, including a temporal one. The temporal focus of prehistoric activity differs between Tosawihi and Mule Canyon. Tosawihi saw an increase in activity in Rosegate times and greater intensification in Desert times (Elston and Drews 1992). In contrast, at Mule Canyon the Middle Archaic is more strongly represented with an increased intensification during Rosegate times (Elston 1994). Until recently we assumed that the observed patterns of obsidian source utilization could be influenced by changes in mobility patterns and range, which may have become more restricted at the end of the Middle Archaic around 700 A.D. (Elston 1986:146), but the 26Ek5040 data argue against temporal change in the use of sources as a likely explanation for the different utilization patterns north and south of the Humboldt.

While explanations involving social or ideological preferences for particular sources cannot be discounted, there is no evidence for non-utilitarian use of obsidian in this part of the Great Basin. At both Tosawihi and Mule Canyon, small quantities of cores and cortical flakes as well as a small number of bifaces and other tools occur in obsidian assemblages, but the obsidian from both projects consists overwhelmingly of pressure flaking debitage, most likely produced in the course of manufacturing, reworking, and rejuvenating projectile points. The preference for obsidian in projectile point

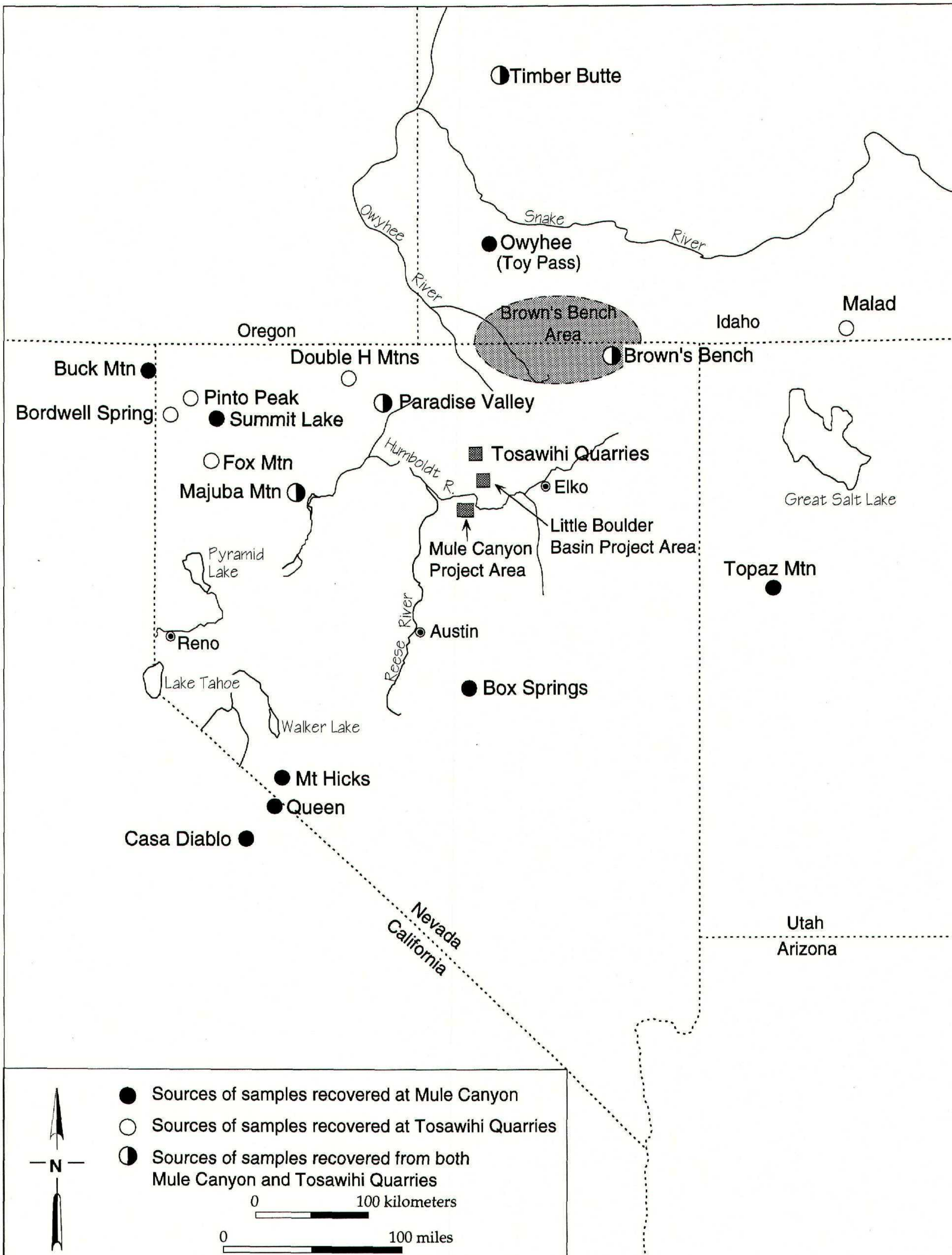

Figure 52. Distribution of Tosawihi Quarries and Mule Canyon obsidian sources.

manufacture may be due simply to flaking ease of that material. No statistically significant source differences for debitage vs. points were noted between the few most important sources or between close and distant sources for either study area.

An obvious explanation for the pattern is that the Humboldt River may have functioned as some sort of territorial boundary. If so, the contradiction in the pattern of opalite and obsidian source access is curious. If, as seems likely from the quantities of opalite recovered from sites south of the river, the prehistoric inhabitants of the Mule Canyon area had direct access to the Tosawihi Quarries, why did they leave no trace of obsidian from sources they exploited south of the river? And if trade mechanisms allowed obsidian from the north to reach Mule Canyon, why didn't obsidian from the south reach Tosawihi?

In attempting to understand the factors that may have produced this pattern, the well known historic and proto-historic boundary between Western Shoshone and Northern Paiute territory (Steward 1937, 1938), which corresponds to dominant lithic raw material utilization zones (Stephenson and Wilkinson 1969:50-52)(cf. Figure 7), comes to mind. With lithic material consisting primarily of Tosawihi opalite east of the line in Shoshone territory, and primarily obsidian on the west in Paiute territory, the lithic resource boundary represents an enduring pattern of raw material use which we assume to be an economic one, based on least cost of acquisition effort. However, as it also reflects a sociopolitical and linguistic boundary, perhaps in this part of the Great Basin social boundaries may also be long-lived.

The coincidental raw material and cultural boundary, and the possibility of the existence of a territorial boundary centered on the Middle Humboldt region south of Tosawihi argues for cultural continuity in the region whether the territories defined are ethnic, political, or economic. It is possible that the large number of unidentified obsidian sources observed in both study areas is significant enough to affect the presently observed pattern. This will become clearer as additional obsidian sources are identified and characterized. It may be that combinations of economic and social factors create persistent patterns on the ground, but the limited nature of prehistoric material culture in the Great Basin renders archaeological explanation of such patterns rather difficult.

Summary

Excavations at 26Ek5040 have revealed a biface manufacturing site with a certain residential character occupied intermittently from as early as pre-Mazama times to the Late Archaic. A pre-Mazama occupation is presented only as a possibility. Mixing of deposits by mechanical and biological processes has obscured the stratigraphic context; for example, a nearly complete metate appearing within a layer of Mazama ash attests to dramatic soil movement rather than to cultural deposition.

Most cultural material on site however, points to the Middle Archaic. Very few intact subsurface features were discovered; thus, most temporal inferences are based on projectile points and uncalibrated obsidian hydration measurements. The bulk of subsurface deposits appear to be Middle Archaic; the somewhat deflated surface is mixed Middle and Late Archaic. There is the possibility of a temporal gap between Middle and Late Archaic occupations. The Late Archaic occupation may have been rather ephemeral; it is represented only by hydration measurements and a near-surface hearth (no Late Archaic points were recovered). Hydration measurement distribution across the site indicates that occupation may have shifted temporally from one part of the site to another.

While there is no significant water source on site today, there once may have been during at least part of the year when the site was occupied. Soils indicate that waterlogged deposits were present at some time in the past. The distribution of groundstone along the main drainage on the site suggests the availability of economically useful plants not seen today. A large source of high quality white opalite toolstone is located approximately 1 km from the site; the opalite material recovered from 26Ek5040 resembles it. The source is a quarry complex which has yet to be investigated.

The focus of site activity is along the central ridge (Feature Group 2). While single reduction events are dispersed across the site, debitage density and most activities unrelated to lithic reduction are more concentrated on the central ridge. The distribution of groundstone tools, which appear along the southern edge of the site, is the exception to this pattern. No heat-treatment hearths were identified with certainty, but the number of heat-failed bifaces and the high proportion of heat-treated debitage at a site within 1 kilometer of a good toolstone source leads us to believe that heat-treatment was common at 26Ek5040

Several factors contribute to the impression of 26Ek5040 as a more residential place than other workshop sites at Tosawihi: the biface industry appears less standardized (perhaps less industrial), more biface use is indicated, biface export form includes finished bifaces, and more flake tools and groundstone were recovered. Perhaps visits to Tosawihi in the Middle Archaic were of longer duration or were undertaken by larger groups than during the Late Archaic.

The obsidian sources used by visitors to Tosawihi in the Middle and Late Archaic were the same. The barrier posed by the Humboldt River south of which obsidian was not acquired may represent a territorial boundary of long standing. Further research in this part of north central Nevada could benefit from close attention to trade patterns through extensive sourcing and hydration analyses and examination of quantities and forms of Tosawihi opalite found outside the Tosawihi production sphere.

Finally, excavation at 26Ek5040 has indicated that certain changes in prehistoric exploitation of the Tosawihi area may have developed between the Middle and Late Archaic. These changes are manifest in material remains in the form of techniques of biface manufacture, export products, and type and variety of tools used at 26Ek5040. These conclusions derive however, from only one site. Future research in the Tosawihi area focused directly on the excavation of sites with single component or stratified occupations, could provide useful data to address issues of temporal change.

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Appendix A

Obsidian Sourcing

August 8, 1994

Ms. Kathryn Ataman
Laboratory Director
Intermountain Research
Drawer 'A'
Silver City, Nevada 89428

Dear Ms. Ataman:

Enclosed with this letter you will find a three-page table presenting x-ray fluorescence (xrf) data generated from the analysis of 50 artifacts (10 tools, 40 debitage samples) from site 26Ek5040 in the Tosawihi opalite quarries area of Elko County, Nevada. This research was conducted pursuant to a letter request from Margaret Bullock, dated July 5, 1994, for IMR project 768.

Laboratory investigations were performed on a Spectrace™ 5000 (Tracor X-ray) energy dispersive x-ray fluorescence spectrometer equipped with a rhodium (Rh) x-ray tube, a 50 kV x-ray generator, with microprocessor controlled pulse processor (amplifier) and bias/protection module, a 100 mHz analog to digital converter (ADC) with automated energy calibration, and a Si(Li) solid state detector with 150 eV resolution (FWHM) at 5.9 keV in a 30 mm² area. The x-ray tube was operated at 35.0 kV, .25 mA, using a .127 mm Rh primary beam filter in an air path at 200 seconds livetime to generate x-ray intensity data for the trace elements zinc (Zn Kα), gallium (Ga Kα), rubidium (Rb Kα), strontium (Sr Kα), yttrium (Y Kα), zirconium (Zr Kα) and niobium (Nb Kα). Barium (Ba Kα) intensities were generated by operating the x-ray tube at 50.0 kV, .35 mA, with a .63 mm copper (Cu) filter at 300 seconds livetime, and iron vs. manganese (Fe Kα/Mn Kα) ratios were computed from data generated by operating the x-ray tube at 12.0 kV, .30 mA, with a .127 mm aluminum (Al) filter at 300 seconds livetime. X-ray intensities were converted to concentration estimates employing a least-squares calibration line established for each element from analysis of up to 26 international rock standards certified by the U.S. Geological Survey, the U.S. National Institute of Standards and Technology (formerly National Bureau of Standards), the Geological Survey of Japan, and the Centre de Recherches Petrographiques et Geochimiques (France). Further details pertaining to x-ray tube operating conditions and calibration appear in Hughes (1988, 1994).

Trace element measurements on the xrf data tables (except Fe/Mn ratios) are expressed in quantitative units (i.e. parts per million [ppm] by weight), and matches between unknowns and known obsidian chemical groups were made on the basis of correspondences (at the 2-sigma level) in diagnostic trace element concentration values (in this case, ppm values for Rb, Sr, Y, Zr, Nb and, when necessary, Ba, and Fe/Mn ratios) that appear in Hughes (1983, 1984, 1985, 1986, 1990, n.d.), Jack and Carmichael (1969), Nelson (1984), Nelson and Holmes (1979) and certain other unpublished data in my possession on other northern Nevada obsidians. Artifact-to-obsidian source (geochemical type) correspondences were considered reliable if diagnostic mean measurements for artifacts fell within 2 standard deviations of mean values for source standards. I use the term "diagnostic" to specify those trace elements that are well-measured by x-ray fluorescence, and whose concentrations show low intra-source variability and marked variability across sources. In short, diagnostic elements are those whose concentration values allow one to draw the clearest geochemical distinctions between sources (Hughes 1990, 1993a; Hughes and Lees 1991). Although Zn, Ga and Nb ppm concentrations also were measured and reported for each specimen, they are not considered "diagnostic" because they don't usually vary significantly across obsidian sources (see Hughes 1982, 1984). This is particularly true of Ga, which occurs in concentrations between 10-30 ppm in nearly all parent obsidians in the study area. Zn ppm values are infrequently diagnostic; they are always high in Zr-rich, Sr-poor peralkaline volcanic glasses, but otherwise they do not vary significantly between sources in the study area.

The trace element composition measurements are reported to the nearest ppm to reflect the calibration-imposed resolution capabilities of non-destructive energy dispersive x-ray fluorescence spectrometry. The resolution limits of the present x-ray fluorescence instrument for the determination of Zn is about 3 ppm; Ga about 2 ppm; for Rb about 4 ppm; for Sr about 3 ppm; Y about 2 ppm; Zr about 5 ppm; and Nb about 3 ppm (see Hughes [1988, 1994] for other elements). When counting and fitting error uncertainty estimates (the "±" value in the table) for a sample are greater than element-specific resolution limits given above, the larger number is a more conservative indicator of composition variation and measurement error due to differences in sample size, surface and x-ray reflection geometry.

The artifact-to-source (geochemical type) attribution for each specimen appears on the data tables, so I will not repeat ascriptions for individual samples. Because I do not have temporal ascriptions for these samples, I have not attempted a breakdown by artifact class, time period and obsidian source (chemical type); informative patterning may emerge when you do this in conjunction with source-specific obsidian hydration rim readings.

Most of these artifacts were fashioned from obsidians of the Paradise Valley chemical type (n=36; cf. Hughes 1990), with Brown's Bench (n=3; Hughes 1990, cf. Hughes and Smith 1993) and Majuba Mountain (n= 3; cf. Hughes 1985) obsidians represented by smaller frequencies. Three samples are have the high-Zr concentration and Fe/Mn ratios within range of geologic samples in my possession from south of Pinto Peak, Summit Lake and Double H Mountains, all west northwest of the project area (these are identical to the samples termed Group 3 in Hughes 1993b, c). Four samples, labelled simply Unknown on the data table, appear to represent a chemically distinct, but geographically unknown, variety of obsidian. While superficially similar to Brown's Bench in Zr composition, these samples contain significantly less Rb and Sr than Brown's Bench. Interestingly, only one example (sample no. 989 from site EU1997) of obsidian of this latter chemical type has been identified in previous analyses of artifacts from the Tosawihi area (Hughes 1993c). One sample (94.8) was fashioned from a non-obsidian parent material.

I hope this information will help in your analysis of these site materials. Please contact me at my laboratory ([916] 364-1074) if I can be of further assistance. As you requested, I have forwarded all samples to Tom Origer for obsidian hydration analysis.

Sincerely,

Richard Hughes

Richard E. Hughes, Ph.D.
Director, Geochemical Research Laboratory

encl.

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Specimen Number	Zn	Ga	Rb	Sr	Y	Zr	Nb	Ba*	Ratio Fe/Mn*	Obsidian Source (Chemical Group)
	Trace Element Concentrations									
94.8	28 ±6	0 ±4	0 ±3	11 ±3	4 ±2	14 ±4	0 ±2	nm	nm	Not obsidian
94.17	61 ±5	22 ±3	197 ±4	45 ±3	65 ±2	411 ±4	43 ±2	nm	nm	Browns Bench
94.21	97 ±4	24 ±3	113 ±3	19 ±3	66 ±2	442 ±4	29 ±2	837 ±13	nm	Unknown
94.63	70 ±5	22 ±3	340 ±4	1 ±3	75 ±2	74 ±3	19 ±2	nm	nm	Paradise Valley
94.69	79 ±5	20 ±4	382 ±4	3 ±3	83 ±2	82 ±3	18 ±2	nm	nm	Paradise Valley
94.83	70 ±4	20 ±3	323 ±4	3 ±3	73 ±2	71 ±3	15 ±2	nm	nm	Paradise Valley
94.93	72 ±4	16 ±3	373 ±4	2 ±3	85 ±2	78 ±3	16 ±2	nm	nm	Paradise Valley
94.142	69 ±4	20 ±3	355 ±4	1 ±6	77 ±2	76 ±3	14 ±2	nm	nm	Paradise Valley
94.145	85 ±5	26 ±4	404 ±5	4 ±3	87 ±2	82 ±4	18 ±2	nm	nm	Paradise Valley
94.147	63 ±4	23 ±3	336 ±4	2 ±3	73 ±2	69 ±3	13 ±2	nm	nm	Paradise Valley
94.149	90 ±5	21 ±4	402 ±5	3 ±3	87 ±2	83 ±4	14 ±2	nm	nm	Paradise Valley
94.151	79 ±5	23 ±3	386 ±4	3 ±3	84 ±2	80 ±3	16 ±2	nm	nm	Paradise Valley
94.152	69 ±4	19 ±3	350 ±4	2 ±3	74 ±2	73 ±3	14 ±2	nm	nm	Paradise Valley
94.164	71 ±5	25 ±3	367 ±5	3 ±3	78 ±2	76 ±4	16 ±2	nm	nm	Paradise Valley
94.166	72 ±4	20 ±3	340 ±4	3 ±3	77 ±2	74 ±3	14 ±2	nm	nm	Paradise Valley
94.243	67 ±4	14 ±3	338 ±4	2 ±3	72 ±2	72 ±3	15 ±2	nm	nm	Paradise Valley
94.244	60 ±4	18 ±3	340 ±4	2 ±3	75 ±2	74 ±3	18 ±2	nm	nm	Paradise Valley

Trace element values (except Fe/Mn ratios) in parts per million (ppm); ± = estimate (in ppm) of x-ray counting uncertainty and regression fitting error at 200 and 300 (*) seconds livetime; nm = not measured.

Specimen Number	Zn	Ga	Rb	Sr	Y	Zr	Nb	Ba*	Ratio Fe/Mn*	Obsidian Source (Chemical Group)
	Trace Element Concentrations									
94.246	66 ±4	20 ±3	355 ±4	2 ±3	79 ±2	72 ±3	15 ±2	nm	nm	Paradise Valley
94.258	65 ±4	21 ±3	366 ±4	2 ±3	85 ±2	80 ±3	16 ±2	nm	nm	Paradise Valley
94.262	74 ±6	26 ±4	361 ±5	2 ±3	82 ±3	77 ±4	14 ±2	nm	nm	Paradise Valley
AG1-2-1.1	60 ±5	19 ±4	198 ±4	48 ±3	63 ±2	432 ±5	43 ±2	nm	nm	Browns Bench
AJ1-5-1.1	78 ±4	20 ±3	348 ±4	2 ±3	76 ±2	75 ±3	12 ±2	nm	nm	Paradise Valley
AM1-4-1.1	76 ±5	21 ±4	357 ±5	1 ±4	80 ±2	77 ±4	13 ±2	nm	nm	Paradise Valley
AN1-4-1.1	82 ±5	22 ±4	401 ±5	3 ±3	86 ±2	80 ±4	14 ±2	nm	nm	Paradise Valley
AN1-4-1.3	188 ±7	23 ±4	212 ±4	4 ±3	98 ±2	513 ±5	29 ±2	nm	76	Pinto Peak or Double H Mtns.
K1-1-1.1	77 ±5	30 ±3	364 ±4	3 ±3	81 ±2	74 ±3	18 ±2	nm	nm	Paradise Valley
P1-4-1.2	56 ±4	12 ±4	146 ±3	106 ±3	20 ±2	156 ±4	11 ±2	nm	35	Majuba Mountain
P1-4-1.3	81 ±5	22 ±3	363 ±4	4 ±3	79 ±2	80 ±3	15 ±2	nm	nm	Paradise Valley
P1-5-1.1	81 ±6	25 ±4	367 ±5	4 ±3	81 ±3	80 ±4	15 ±2	nm	nm	Paradise Valley
P1-5-1.2	48 ±5	14 ±4	145 ±3	106 ±3	19 ±2	153 ±4	10 ±2	nm	36	Majuba Mountain
Q5-4-1.1	207 ±6	25 ±4	219 ±4	3 ±3	101 ±2	537 ±5	27 ±2	nm	73	Pinto Peak or Double H Mtns.
Q5-5-1.2	87 ±5	18 ±4	384 ±5	3 ±3	82 ±2	79 ±4	17 ±2	nm	nm	Paradise Valley
Q5-5-1.3	60 ±5	13 ±3	164 ±3	122 ±3	25 ±2	175 ±4	10 ±2	nm	37	Majuba Mountain
Q5-6-1.2	79 ±5	26 ±4	374 ±4	3 ±3	82 ±2	79 ±3	10 ±2	nm	nm	Paradise Valley

Trace element values (except Fe/Mn ratios) in parts per million (ppm); ± = estimate (in ppm) of x-ray counting uncertainty and regression fitting error at 200 and 300 (*) seconds livetime; nm = not measured.

Specimen Number	Trace Element Concentrations								Ratio	
	Zn	Ga	Rb	Sr	Y	Zr	Nb	Ba*	Fe/Mn*	Obsidian Source (Chemical Group)
Q6-1-1.1	87 ±5	25 ±4	394 ±5	4 ±3	85 ±2	82 ±4	14 ±2	nm	nm	Paradise Valley
Q6-6-1.2	77 ±5	20 ±4	402 ±5	2 ±3	89 ±2	81 ±4	15 ±2	nm	nm	Paradise Valley
Q7-2-1.2	78 ±5	24 ±4	383 ±5	3 ±3	83 ±2	79 ±4	18 ±2	nm	nm	Paradise Valley
Q7-5-1.1	60 ±6	19 ±4	388 ±5	3 ±3	85 ±2	80 ±4	14 ±2	nm	nm	Paradise Valley
Q8-1-1.1	78 ±5	20 ±4	397 ±5	4 ±3	85 ±2	83 ±4	16 ±2	nm	nm	Paradise Valley
Q8-5-1.4	75 ±5	14 ±4	222 ±4	47 ±3	65 ±2	431 ±5	48 ±2	nm	nm	Browns Bench
R1-1-1.1	83 ±6	23 ±4	408 ±5	0 ±5	86 ±2	83 ±4	15 ±2	nm	nm	Paradise Valley
S1-1-1.1	81 ±5	28 ±3	382 ±5	2 ±3	85 ±2	79 ±4	14 ±2	nm	nm	Paradise Valley
S2-5-1.1	150 ±7	25 ±4	180 ±4	4 ±3	92 ±2	489 ±5	28 ±2	nm	71	Pinto Peak or Double H Mtns.
T2-4-1.1	84 ±6	24 ±4	390 ±5	4 ±3	86 ±2	84 ±4	17 ±2	nm	nm	Paradise Valley
T2-5-1.1	74 ±5	18 ±4	355 ±5	3 ±3	80 ±2	78 ±4	14 ±2	nm	nm	Paradise Valley
T2-5-1.2	72 ±4	19 ±3	344 ±4	2 ±3	80 ±2	73 ±3	16 ±2	nm	nm	Paradise Valley
V3-1-1.1	90 ±6	30 ±4	382 ±5	4 ±3	81 ±3	81 ±4	18 ±2	nm	nm	Paradise Valley
Y1-1-1.1	98 ±5	22 ±3	118 ±3	20 ±3	64 ±2	463 ±5	35 ±2	931 ±13	nm	Unknown
Y1-3-1.3	108 ±5	27 ±4	120 ±3	24 ±3	69 ±2	457 ±5	31 ±2	958 ±14	nm	Unknown
Y1-3-1.4	87 ±6	20 ±4	113 ±3	18 ±3	66 ±2	432 ±5	30 ±2	975 ±14	nm	Unknown

Trace element values (except Fe/Mn ratios) in parts per million (ppm); ± = estimate (in ppm) of x-ray counting uncertainty and regression fitting error at 200 and 300 (*) seconds livetime; nm = not measured.

Appendix B

Obsidian Hydration

SONOMA STATE UNIVERSITY
ACADEMIC FOUNDATION, INC.

ANTHROPOLOGICAL STUDIES CENTER
CULTURAL RESOURCES FACILITY
707 664-2381 FAX 707 664-4155

Foundation Center, Bldg. 300
1801 East Cotati Avenue
Rohnert Park, California 94928-3609

Ms. Kathryn Ataman
Intermountain Research
Drawer A
Silver City, Nevada
89428

September 2, 1994

Dear Kathryn:

This letter reports hydration band measurements obtained from 49 obsidian specimens from site 26EK5040 in the Tosawihi opalite quarries in Elko County, Nevada. This hydration work was completed according to your request following source determination of the specimens by Richard Hughes who forwarded the items to us. Note that only 49 specimens were analyzed because Richard Hughes determined that one was not obsidian.

The analysis was completed at the Sonoma State University Obsidian Hydration Lab, an adjunct of the Anthropological Studies Center, Department of Anthropology. Procedures used by our hydration lab for preparation of thinsections and measurement of hydration bands are described below.

Each specimen was examined to find one or more surface facets that would yield edges which would be perpendicular to the microslide when preparation of the thin section was completed. Generally, two small parallel cuts are made at the selected location along the edge of the specimens with a four-inch diameter circular saw blade mounted on a lapidary trimsaw. The cuts result in the isolation of a small sample with a thickness of about one millimeter. Samples are removed from the specimen and mounted with Lakeside Cement onto a permanently etched petrographic microslide.

The thickness of each sample was reduced by manual grinding with a water based slurry of #500 silicon carbide abrasive on a glass plate. The grinding was completed in two steps. The first grinding was stopped when a sample's thickness was reduced by about one-half. This eliminated any micro-chips created by the saw blade during the cutting process. Each slide was then reheated, which liquefied the Lakeside Cement, and the samples inverted. Newly exposed surfaces were then ground until the proper thickness was attained.

The correct thin section thickness was determined by the "touch" technique. A finger was rubbed across the slide, onto the sample, and the difference (sample thickness) was "felt." The second technique employed for arriving at proper thin section thickness is termed the"transparency" test. Each microslide was held up to a strong source of light and the translucency of the thin section observed. Samples were sufficiently reduced in thickness when the thin sections readily allowed the passage of light. A coverslip was affixed over the thin sections when grinding was completed. Completed microslides are curated at our hydration lab under File No. 94-H1360.

Hydration bands were examined and measured with a strainfree 40 power objective and a Bausch and Lomb 12.5 power filar micrometer eyepiece on a Nikon petrographic microscope. Six measurements were taken at locations along the edge of the thin section, and the mean of the measurements was calculated and listed on the enclosed table with other information. Note, the hydration measurements have a range of +/- 0.2 due to normal limitations of the equipment.

The abbreviations "DH" and "NVB" on the enclosed pages under the "Mean" column mark specimens having diffuse hydration or no visible hydration band, respectively.

If you have questions regarding this hydration work, please do not hesitate to contact me.

Sincerely,

Thomas M. Origer, Director
Obsidian Hydration Laboratory

26EK5040 Submittor: K. Ataman - Intermountain Research September 6, 1994

Lab#	Catalog#	Description	Unit	Level	Remarks	Measurements	Mean	Source
1	0-0-94.17	Rosegate/Elko?		surface	none		NVB	
2	0-0-94.69	Biface fragment		surface	none	5.1 5.1 5.1 5.3 5.4 5.5	5.3	
3	0-0-94.142	Elko?		surface	none	6.0 6.0 6.0 6.0 6.1 6.1	6.0	
4	0-0-94.262	Point fragment		surface	none		DH	
5	P1-4-1.3	Point fragment	P1	4	none	6.0 6.0 6.0 6.0 6.1 6.1	6.1	
6	P1-5-1.2	Core	P1	5	none	5.1 5.1 5.1 5.1 5.3 5.4	5.2	
7	Q5-4-1.1	Biface fragment	Q5	4	none	4.7 4.8 4.8 4.8 4.9 4.9	4.8	
8	S2-5-1.1	Point fragment	S2	4	none	4.7 4.7 4.7 4.8 4.8 4.8	4.8	
9	T2-4-1.1	Point fragment	T2	4	none	4.5 4.5 4.7 4.7 4.7 4.8	4.7	
10	AJ1-5-1.1	Point	AJ1	5	none	4.4 4.4 4.4 4.4 4.5 4.5	4.4	
11	0-0-94.21	Debitage		surface	none	1.2 1.2 1.2 1.2 1.2 1.3	1.2	
12	0-0-94.63	Debitage		surface	none	4.7 4.8 4.8 4.8 4.8 4.8	4.8	
13	0-0-94.83	Debitage		surface	none	5.3 5.3 5.4 5.4 5.4 5.5	5.4	
14	0-0-94.93	Debitage		surface	none	5.6 5.7 5.7 5.7 5.8 5.8	5.7	
15	0-0-94.145	Debitage		surface	none	6.7 6.7 6.7 6.7 6.8 6.8	6.7	
16	0-0-94.147	Debitage		surface	none		NVB	
17	0-0-94.149	Debitage		surface	none	1.3 1.3 1.3 1.3 1.4 1.4	1.3	
18	0-0-94.151	Debitage		surface	none	1.1 1.2 1.2 1.2 1.3 1.3	1.2	
19	0-0-94.152	Debitage		surface	none	1.2 1.2 1.2 1.2 1.3 1.3	1.2	
20	0-0-94.164	Debitage		surface	none	5.4 5.4 5.4 5.5 5.6 5.6	5.5	
21	0-0-94.166	Debitage		surface	none	1.7 1.7 1.7 1.7 1.8 1.8	1.7	
22	0-0-94.243	Debitage		surface	none	6.3 6.4 6.4 6.4 6.7 6.8	6.6	
23	0-0-94.244	Debitage		surface	none	1.2 1.3 1.3 1.4 1.4 1.6	1.4	
24	0-0-94.246	Debitage		surface	none	1.3 1.3 1.3 1.4 1.4 1.4	1.4	
25	0-0-94.258	Debitage		surface	none	3.2 3.2 3.3 3.3 3.3 3.5	3.3	
26	K1-1-1.1	Debitage		surface	none	7.6 7.6 7.8 7.8 7.9 7.9	7.8	
27	P1-4-1.2	Debitage		surface	none	5.6 5.6 5.6 5.6 5.7 5.8	5.7	
28	P1-5-1.1	Debitage		surface	none	5.6 5.6 5.6 5.7 5.8 5.8	5.7	
29	Q5-5-1.2	Debitage		surface	none	5.4 5.5 5.5 5.6 5.6 5.7	5.6	
30	Q5-5-1.3	Debitage		surface	none	5.0 5.1 5.1 5.3 5.3 5.4	5.2	
31	Q5-6-1.2	Debitage	Q5	6	none	5.3 5.4 5.4 5.5 5.5 5.5	5.4	
32	Q6-1-1.1	Debitage	Q6	1	none	1.2 1.2 1.2 1.2 1.2 1.4	1.2	
33	Q6-6-1.2	Debitage	Q6	6	none	5.1 5.3 5.3 5.3 5.3 5.3	5.3	
34	Q7-2-1.2	Debitage	Q7	2	none	6.7 6.7 6.7 6.7 6.8 6.8	6.7	
35	Q7-5-1.1	Debitage	Q7	5	none	4.7 4.8 4.9 4.9 5.0 5.0	4.9	
36	Q8-1-1.1	Debitage	Q8	1	none	4.7 4.7 4.8 4.8 4.8 4.9	4.8	
37	Q8-5-1.4	Debitage	Q8	5	none	7.9 7.9 8.0 8.0 8.1 8.2	8.0	
38	R1-1-1.1	Debitage	R-1	1	none	8.0 8.1 8.1 8.1 8.1 8.2	8.1	
39	S1-1-1.1	Debitage	S-1	1	none	5.8 5.8 6.0 6.0 6.0 6.1	6.0	
40	T2-5-1.1	Debitage	T-2	5	none	5.4 5.5 5.5 5.5 5.6 5.7	5.5	
41	T2-5-1.2	Debitage	T-2	5	none	5.6 5.6 5.6 5.6 5.8 5.8	5.7	
42	V3-1-1.1	Debitage	V3	1	none	1.4 1.4 1.6 1.7 1.7 1.7	1.6	
43	Y1-1-1.1	Debitage	Y1	1	none	1.2 1.2 1.2 1.2 1.2 1.3	1.2	
44	Y1-3-1.3	Debitage	Y1	3	none	1.2 1.2 1.3 1.3 1.3 1.3	1.3	
45	Y1-3-1.4	Debitage	Y1	3	none	1.1 1.2 1.2 1.2 1.2 1.2	1.2	
46	AG1-2-1.1	Debitage	AG1	2	none		NVB	
47	AM1-4-1.1	Debitage	AM1	4	none	5.5 5.5 5.6 5.6 5.6 5.6	5.6	

26EK5040 Submittor: K. Ataman - Intermountain Research September 6, 1994

Lab#	Catalog#	Description	Unit	Level	Remarks	Measurements	Mean	Source
48	AN1-4-1.1	Debitage	AN1	4	none	4.9 4.9 5.0 5.0 5.0 5.0	5.0	
49	AN1-4-1.3	Debitage	AN1	4	none		DH	

Lab Accession No.: 94-H1360 Technician: Thomas M. Origer

Appendix C

Radiocarbon Assays

BETA ANALYTIC INC.

DR. J.J. STIPP and DR. M.A. TAMERS

UNIVERSITY BRANCH
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305/667-5167 FAX: 305/663-0964

REPORT OF RADIOCARBON DATING ANALYSES

FOR: Dr. Robert G. Elston
Intermountain Research

DATE RECEIVED: March 10, 1994
DATE REPORTED: April 6, 1994
SUBMITTER'S PURCHASE ORDER #

TECHNIQUE AND BASIS: Radiometric

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ±1σ	C13/C12	C13 adjusted age
eta-71239	26EK5040-UP (Organic Sediment)	4380 ± 90 BP	-25.0* o/oo	4380 ± 90* BP

ESTIMATED C13/C12 ratio and adjusted age (used in calendar calibration). Ratio assumed to be identical to the reference standard (age does not change).

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

BETA ANALYTIC INC.

RADIOCARBON DATING SERVICES

Dr. JERRY J. STIPP
Dr. MURRY A. TAMERS
CO-DIRECTORS

DARDEN G. HOOD, P.G.
Laboratory Manager
RONALD E. HATFIELD
CHRISTOPHER PATRICK
TERESA A. ZILKO-MILLER
Associate Managers

Dr. Robert G. Elston
Intermountain Research
Drawer A
Silver City, Nevada 89428

April 6, 1994

Dear Dr. Elston:

Please find enclosed the result on the organic sediment sample (26EK5040-UP) submitted for radiocarbon dating analysis on March 10, 1994. It was necessary to use the entire sample for the analysis.

The sample was saturated with de-ionized water, sieved of rootlets, and rinsed in hot acid to remove carbonates. After drying and final inspection, aliquots were repeatedly combusted to obtain a sufficient quantity of carbon dioxide gas, which was synthesized to benzene and analyzed for C14 content. The date represents the total organic content of the sediment.

Also included is the dendrocalibration of the date. This graphic representation allows for experimentation to illustrate changes in the calibrated age with changes in the radiocarbon age. We've used the same international data base as in other programs but the mathematical treatment is more appropriate. It is presented in collaboration with the Quaternary Dating Research Unit in Pretoria, South Africa, directed by Dr. John Vogel, to whom we credit the calibration. For interpretation purposes, note the caveats and our recommendation to use the two sigma range. Please report the original data in the form of a table in publications so that future refinement of calibration data can be applied to your research. Hopefully the attached cover sheets will answer your questions.

A discussion of calibrating radiocarbon dates calculated with estimated C13/C12 ratios is included on the back of the calibration explanation page. We have refined the date report format to include estimated C13/C12 ratios and adjusted ages for the purposes of calibration and completing your tables. You will notice the uncorrected and corrected ages are the same since a constant was used.

Our invoice is enclosed. Would you please forward it to your purchasing department for payment. As always, if you have any questions, do not hesitate to contact us. We are sending this report by both mail and fax. This sample is number 17 in this year's discount period, valid through June 1994.

Sincerely,

Darden Hood

4985 S.W. 74 COURT, MIAMI, FL, 33155 U.S.A.
TELEPHONE: 305-667-5167 / FAX: 305-663-0964 / BITNET: XNRBET22@SERVAX

BETA ANALYTIC INC.

DR. J.J. STIPP and DR. M.A. TAMERS

UNIVERSITY BRANCH
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305/667-5167 FAX: 305/663-0964
E-mail: beta@analytic.win.net

REPORT OF RADIOCARBON DATING ANALYSES

FOR: Dr. Robert G. Elston
Intermountain Research

DATE RECEIVED: Auth. August 19, 1994
DATE REPORTED: September 16, 1994

Sample Data	Measured C14 Age	C13/C12 Ratio	Conventional C14 Age (*)
Beta-74722	850 +/- 200 BP	-25.0* o/oo	850 +/- 200* BP

SAMPLE #: 26Ek5040-AM1-3-6.1
ANALYSIS: radiometric-standard
MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid
COMMENT: the small sample was given extended counting time

NOTE: One additional sample (26Ek5040-Q5-2-3.4) was submitted but not analyzed as instructed.

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By International convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

Appendix D

Tephra Analysis

Washington State University

Department of Geology

Pullman, WA 99164-281
509-335-300
FAX: 509-335-781

September 2, 1994

Dan Dugas, Geoarchaeologist
Intermountain Research
Drawer A
Silver City, Nevada 89428

Dear Dan,

We analyzed the sample you provided and the results are given in the attached table. As you can see (and I believe as you expected) it matches Mazama Climactic glass to a T.

Sorry this took longer than usual. Just as your sample arrived the sample preparation technician left for vacation.

Sincerely,

Nick

Franklin F. (Nick) Foit, Jr.
Professor and Director of Microbeam Lab

TABLE 1. GLASS CHEMISTRY OF INTERMOUNTAIN RESEARCH SAMPLE

Oxide	26EK5040AH2-25
SiO2	72.90(0.22)
Al2O3	14.50(0.16)
Fe2O3	2.16(0.07)
TiO2	0.42(0.03)
Na2O	5.01(0.10)
K2O	2.68(0.07)
MgO	0.49(0.04)
CaO	1.67(0.06)
Cl	0.17(0.02)
Total**	100
Number of shards analyzed	16
Probable Source	Mazama Climactic 6850 BP
Similarity Coefficient	0.98-0.99

* Standard deviations of the analyses given in parentheses
** Analyses normalized to 100 weight percent

Sample name: Dugas Intermountain Research 26EK5040AH2-25

SiO2	TiO2	Al2O3	MgO	CaO	BaO	MnO	Fe2O3	Na2O	K2O	Cl	Total
72.90	0.42	14.50	0.49	1.67	0.00		2.16	5.01	2.68	0.17	100.00
1.00	0.25	1.00	0.25	1.00	0.00	0.00	1.00	1.00	1.00	weighting factor (only for oxides in bold type)	

Similarity Coefficients for 15 closet matches

SiO2	TiO2	Al2O3	MgO	CaO	Fe2O3	Na2O	K2O	sim coef weighted avg	rec#	Std	Date	State	Source/Age	Notes	weighted a
1.000	0.977	0.996	0.980	0.988	0.977	0.994	0.993	0.990	705		31-Jan-94	OR	Mazama 6850 BP	Sample 913-01-P7-ASH recovered from Unit N196E174 at a depth of 30-35 cm from Site 35KL2101 (La Sere Site) in Drews Valley, roughly 17 miles west of Lakeview, OR, Dennis Jenkins, OR Museum of Anthropology, O of O	
0.997	1.000	0.994	0.959	0.964	0.986	0.998	1.000	0.989	216			WA	Mazama/6850	Sample #1, IHS Clinic near Yakima Indian Agency, G. Cleveland, Yakima Indian Nation	
0.999	1.000	0.996	0.959	0.958	0.995	0.988	0.989	0.987	707		1-Mar-94	ID	Mazama 6850 BP	Sample #2, soil B horizon, 20 cm depth, Selkirk Mountains, Boundary County, Idaho; Paul McDaniels, Dept Of Plant, Soil & Entomological Sciences, U of Idaho	
0.999	1.000	0.995	1.000	0.971	0.991	0.960	0.996	0.987	346			OR	Mazama/6850	Willowdale	
0.997	0.976	0.999	0.918	0.964	0.995	0.986	0.996	0.986	457			OR	Mazama 6850 ?	Sample 35JE283, 398-2; Infotec, Willowdale Quad.	
1.000	0.955	0.997	0.959	0.958	0.995	0.982	1.000	0.986	698		31-Jan-94	OR	Mazama 6850 BP	Sample 35UN82-33-1 from site 35UN82, TU-1, depth 66-71 cm in Union County, just south of La Grande, OR in the foothills above the Grand Ronde Valley, Archaeological Investigations NW, Portland, Doug Wilson	
0.998	0.976	0.992	0.939	0.964	0.977	1.000	0.993	0.985	549			WA	Mazama 6850 BP ????	Sample 45FR54-05A, Palouse Canyons, B. Hicks, BOAS, Inc., Seattle	
0.998	0.976	0.996	0.898	0.982	0.977	0.982	0.996	0.985	318			OR	Mazama/6850	10BY309, SON-12-75-1, INFOTEC, North Central Idaho near Meadow Creek	
1.000	0.977	0.999	0.898	0.982	0.977	0.988	0.985	0.985	699		31-Jan-94	OR	Mazama 6850 BP	Sample 35UN82-36-1 from site 35UN82, TU-1, depth 86-91 cm, in Union County, just south of La Grande, OR in the foothills above the Grand Ronde Valley, Archaeological Investigations NW, Portland, Doug Wilson	
0.999	0.977	0.997	0.939	0.964	0.977	0.990	0.993	0.984	319			OR	Mazama/6850	35JE51B, SOX-6-130-1, Ash #1, INFOTEC, North Central OR north of Willowdale	
0.998	0.952	0.999	0.939	0.964	0.991	0.984	0.989	0.984	188			ID	Mazama/6850	101H1639 Pittsburg Landing, B. Cochran, Pittsburg Arch. Project, USFS	
1.000	1.000	0.996	0.939	0.970	0.981	0.979	0.985	0.984	709		1-Mar-94	MT	Mazama 6850 BP	Sample SCT-1, NWSE S15,0-110cm depth along Cow Creek, Fort Connah 7.5" Quad. (Lake County., MT), Daniel Levish, D-3611, Bur. of Reclamation, Denver, CO 80225-0007	
0.997	1.000	0.990	0.898	0.958	0.977	0.998	1.000	0.984	449			ID	Mazama 6850 BP ?	Idaho Historical Research Society, B. Cochrane, locality not given	
0.997	0.976	0.990	0.837	0.988	1.000	0.998	0.964	0.983	531			WA	Mazama ???	EWU #2 (glass 2) from site 45AD-104, along HWY in Lind SW USGS Quad, 7.5' Series, SE Washington, Vera Morgan, Archaeological & Histotical Services	
0.999	1.000	0.988	0.939	0.970	0.956	0.994	1.000	0.983	448			OR	Mazama 6850 BP ?	Site/Sample 35JA222, Hyatt Lk Quad, E 1/2 Sec. 10, 53 mi SW Crater Lk, 55 mi NW Mt Shasta, Nan Hannon, So. Or. Historical Soc.	

number of records searched: 735

Appendix E

List of Illustrated Artifacts

Figure 24. Selected Stage 3 bifaces.

a. N3-3-1-4
b. 0-0-94-39
c. 0-0-94-216

Figure 25. Selected Stage 4 bifaces.

a. 0-0-94-235
b. 0-0-94-203
c. 0-0-94-44
d. 0-0-94-190
e. 0-0-94-168
f. 0-0-94-4

Figure 26. Selected Stage 5 bifaces.

a. MS3-0-1-5
b. T2-1-1-2
c. N3-3-1-5
d. 0-0-94-248
e. 0-0-94-102
f. 0-0-94-209

Figure 28. Selected projectile points.

a. 0-0-94-229
b. 0-0-94-279
c. Q6-1-1-7
d. 0-0-94-17
e. 0-0-94-257
f. Q6-4-5-1
g. 0-0-94-132
h. AO1-1-1-14
i. Q7-1-1-2
j. 0-0-94-2
k. 0-0-94-142
l. AJ1-5-1-1
m. Q6-4-1-4
n. 0-0-94-197
o. S2-5-1-1
p. 0-0-94-13
q. 0-0-94-223
r. 0-0-94-259

Figure 29. Selected scrapers and pointed tools.

a. Q8-1-1-10
b. AA2-1-1-19
c. Q5-1-2-8
d. L4-1-1-5
e. AH1-1-1-3
f. 0-0-94-66
g. 0-0-94-253
h. 0-0-94-277
i. AD3-1-1-11
j. AK1-3-2-1
k. MS4-0-1-1

Figure 30. Selected notched tools, miscellaneous retouched flakes, and bifacial flake tools.

a. AG1-7-1-6
b. 0-0-94-185
c. Q6-1-1-18
d. O3-1-1-6
e. 0-0-94-378
f. 0-0-94-202
g. 0-0-94-9
h. Q5-4-1-4
i. 0-0-94-73
j. 0-0-94-6
k. N3-1-1-9
l. 0-0-94-87
m. 0-0-94-192

Figure 31. Hammerstone.

a.TC-0-1-1

Figure 32. Battered slabs.

a. MS1-0-1-5
b. MS1-0-1-3

Figure 33. Other battered artifacts.

a. MS2-0-1-7
b. 0-0-94-254

Figure 34. Selected manos.

a. Q7-3-2-1
b. 0-0-94-271/0-0-94-270

Figure 35. Pestle.

a. TD-0-1-1

Figure 37. Selected cores.

a. P1-5-1-2
b. AN1-3-1-14
c. Q6-5-4-1
d. R3-1-1-9

Figure 38. Selected modified chunks.

a. AN1-3-1-14
b. 0-0-94-57
c. 0-0-94-121
d. 0-0-94-85

Appendix F

Projectile Point Measurements

Appendix F. Projectile Point Measurements.

Unit	Level	Lot	Spec	Feature	Thickness	Weight	Baseth	Lt	La	Lm	Wm	Wb	Neckw	DSA	PSA	DSA/ PSA	Lalt	WbWm	LtWm	LmLt	Type	Material
0	0	94	2	0	4.9	3.2	3.4	0.0	0.0	0.0	0.0	15.7	13.3	165	124	41	0.00	0.00	0.00	0.00	4	9
0	0	94	13	0	5.5	2.9	4.6	33.2	31.7	10.0	19.6	12.4	9.6	180	100	80	0.95	0.63	3.32	0.30	5	4
0	0	94	17	0	5.5	1.7	4.5	22.9	20.0	0.3	19.3	8.2	0.9	169	112	57	0.88	0.42	0.84	0.01	9	2
0	0	94	54	0	3.5	1.8	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
0	0	94	132	0	7.4	4.6	6.4	39.3	35.5	12.0	19.0	15.4	13.0	241	118	123	0.90	0.81	2.00	0.31	4	4
0	0	94	142	0	4.1	1.6	3.2	26.2	19.2	0.8	20.7	12.9	1.1	165	113	52	0.73	0.62	1.26	0.30	4	2
0	0	94	197	0	7.5	3.2	4.4	30.3	29.2	0.0	0.0	12.3	9.6	152	122	30	0.96	0.00	0.00	0.00	4	4
0	0	94	223	0	3.8	1.4	2.0	0.0	0.0	0.0	21.9	11.9	12.2	165	68	97	0.00	0.55	0.00	0.00	5	4
0	0	94	229	0	6.7	7.5	3.8	0.0	0.0	0.0	17.8	13.8	0.0	0	0	0	0.00	0.77	0.00	0.00	6	9
0	0	94	232	0	5.1	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
0	0	94	257	0	7.2	5.7	6.7	36.5	25.6	10.9	21.2	17.8	16.0	0	0	0	0.70	0.85	1.72	0.30	9	4
0	0	94	259	0	6.3	4.4	3.9	35.1	33.5	35.6	0.0	11.1	12.9	145	85	60	0.95	0.00	0.00	1.00	5	4
0	0	94	260	0	6.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
0	0	94	262	0	3.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	2
0	0	94	279	0	6.6	4.4	3.6	40.2	38.3	0.0	15.0	5.5	0.0	0	0	0	1.00	0.70	2.28	0.00	6	4
AA2	1	1	20	27	2.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	9
AD1	1	1	4	30	5.6	2.4	3.9	0.0	0.0	0.0	0.0	13.0	10.7	176	114	62	0.00	0.00	0.00	0.00	4	4
AJ1	5	1	1	0	3.9	1.9	3.1	30.4	25.0	0.5	18.6	10.1	8.9	166	136	30	0.82	0.54	1.60	0.02	4	2
AM1	3	1	3	0	3.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
P1	4	1	3	0	6.7	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	2
P2	1	1	10	10	2.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
Q5	6	1	4	0	4.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
Q6	1	1	7	0	4.1	1.0	3.3	18.1	14.1	0.0	14.2	14.0	0.0	0	0	0	0.00	0.98	0.00	0.00	9	4
Q6	4	1	4	33	5.5	2.4	4.0	0.0	0.0	0.0	0.0	0.0	9.6	0	110	0	0.00	0.00	0.00	0.00	4	9
Q6	6	1	12	0	5.7	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
Q6	4	5	1	33	4.8	3.0	3.7	36.7	34.9	6.2	25.0	12.6	11.6	172	118	54	0.95	0.50	1.46	0.16	4	4
Q7	4	1	8	0	4.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
Q8	3	1	6	11	7.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
S2	5	1	1	0	3.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	7	2
T2	4	1	1	0	4.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	2
V4	1	1	9	17	6.2	4.4	5.1	30.7	27.1	0.0	5.1	5.1	0.0	0	0	0	0.00	1.00	0.00	0.00	10	4
Q7	1	1	2	11	6.1	2.2	3.5	0.0	26.2	0.0	0.0	14.5	10.2	145	119	26	0.00	0.00	0.00	0.00	4	4
R1	1	1	6	0	5.8	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4
X2	1	1	5	22	5.2	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0.00	0.00	0.00	0.00	10	4

Type Key: 4=Elko Series; 5=Gatecliff Series; 6=Humboldt Series; 7=Large Side-notch Series; 9=Out of Key; 10=Fragment
Material Key: 2=Obsidian; 4=Tosawihi Opalite; 9=Exotic Chert.

Measurement abbreviations follow Thomas (1981).

Appendix G

Macrofossil Analysis

Botanical Analysis of Flotation Samples from Site 26Ek5040, near Tosawihi Quarries

Nancy A. Stenholm

Introduction

The study of vegetable materials found in archaeological matrices, termed archaeobotany or paleoethnobotany, provides valuable information about the resource base of peoples inhabiting a site. Botanical material, with lithic and faunal data, gives archaeologists means to infer patterns of subsistence, to interpret site features, and to suggest seasonality or site function.

Methods

Although vegetable materials utilized by prehistoric people decay rapidly, evidence of plant gathering preparation and use is often preserved as charred, microscopically identifiable particles contained in soil samples. Because these materials are seldom recovered *in situ* or during routine screening, general processing procedures for botanical samples are different from those used for faunal material and lithics. Methods used for recovery of charred plant remains from 26EK5040 are described in Chapter 2 of the site report.

Identification of floated residues is done with the aid of a zoom binocular microscope with continuous magnification to 150 x. Weights are taken in milligrams rounded to the nearest hundredth of a gram. Tabulation and recording are made on the botanical scan sheet. A primary distinction is made between charred (or semi-charred) material and non-charred material since the carbonized material resists decay for considerable periods of time. The non-charred material is more likely to represent recent materials incorporated into the sample matrix through bioturbation. The uncharred floral material is identified and noted.

Microscopic analysis begins with manual separation of charred and semi-charred botanical materials from all other materials in the subsample. Both groups are weighed, and the amount of archaeobotanical charcoal is recorded. This figure aids in estimating the total carbon or the total uncarbonized flora in the sample (the "carbon/uncarbonized flora percentage or carbon/flora content"). A check of the float sample may confirm the possibility through presence of insect parts, modern flora or rodent remains.

Analysis proceeds with identification of carbonized material to taxa. The material is divided into woody material, seeds, surface and subsurface fruit, root, and stem tissue, and dissociated tissue types. For the most part, family and genus identifications can be made from wood and seeds, some bark and certain portions of stem tissue (including bud, flower, leaf, and fruit fragments). For instance, conifer needles preserve well, and they are relatively easy to identify compared with the more fragile leaves of hardwood species. Species identification is more difficult. Tissues rarely can be identified taxonomically, but the distinction of general tissue types can be important in assessing preservation factors as well as presence of processing and technological activities. Presence of fibers and bark tissues, for instance, may indicate cordage production. Seed coat fragments may indicate fruit or seed processing associated with grinding or pounding. Other tissues may be remnants from processing soft parts of foods and medicines. Such dissociated tissues can be divided into groups. A glassy or shiny material may represent plant saps,-juices, or resins. It is amorphous black or dark brown material with bubble or steam cavities. When it is found with wood cells it is most likely to be wood pitch or conifer resin. When it is associated with other softer tissue types, such as starchy parenchymoid or fruity epithelioid tissues, it may processed edible tissue (PET). At the moment, the PET category is divided into two groups: tissue which resembles sugar-laden fruit or berry tissue with (PET fruity) or without the seeds (PET other); and, tissue with starchy storage cells (PET starchy), likely from edible roots.

Analysis of a flotation sample ends after the remainder of the light fraction and all of the heavy fraction have been scanned for diagnostic pieces of charcoal, lithics, bone, shell, and other cultural material. Diagnostic floral material is added to the data sheet and its presence in the flot is registered as a trace (less than 0.01 g). Lithics, bone, and shell are weighed and they may be counted as well. The presence of burned earth, pigment, and historic materials is noted. Modern rodent, insect, and plant remains are kept in order to determine species active in the environment influencing bioturbation. Ancient bioturbation is indicated by charred insect dissemules.

The Study

This report concerns 10 flotation samples (which are derived from 5 archaeological features) from 26Ek5040 , a site adjacent to Tosawihi Quarries. Table 1 shows the flotation samples by weight, volume, carbon content in grams, and as percentages of the sample weight. The flotation samples produced 10 plant taxa from 2 g of archaeobotanical materials extracted from approximately 27.5 kg of site matrix (cf. Table 1). The botanical array is shown in Table 2.

Table 1. Flotation Sample Summary Weight, Volume, and Carbon Content including Carbon Content, Lithic Flakes, and Bone.

Feature Number	Catalog Number	Weight g	Carbon g	Carbon C%	Lithics #	Lithics g	Bone g
33	Q5-2.3.3	604	0.50	0.08%	55	1.6	0.00
34	AM2-1.1.1	3600	0.02	<0.01%	254	11.9*	0.00
34	AM2-1.1.2	3200	0.12	<0.01%	169	8.0*	0.01
34	AM1-3.3.1	3200	0.04	<0.01%	227	13.7	0.00
34	AM1-3.4.1	3000	0.02	<0.01%	164	9.9*	0.00
34	AM1-3.5.1**	2200	0.37	0.02%	131	2.3*	0.00
39	AN1-1.2.1	2800	0.04	<0.01%	704	41.2*	0.09
39	AN1-3.2.1	2200	0.05	<0.01%	3000	373.2*	0.00
40	MS7A-1.2.1	3000	0.77	0.03%	162	13.9*	0.03
41	MS7B-1.1.1	3600	0.01	<0.01%	167	31.4*	0.00
Total		27404	1.94	>0.13%	5033	507.1	0.13

* one to two obsidian flakes present
** sample sorted by Intermountain Research

All flotation samples contained scanty charcoal; several were pre-sorted to collect radiocarbon samples.

All samples have large arrays of CCS flakes and chunks. Most are white, and some appear heat-treated. Obsidian flakes (N=14) appear in all Features but Feature 33.

Unburned bone appears in two samples, and calcined bone appears in Feature 40.

All flotation samples have insect dissemules (mostly ant and beetle parts); and, all contained modern uncharred floral material (such as, wood, leaf tissue, monocot and herbaceous stem tissues, seeds). Three contained ancient charred insect dissemules.

The Tosawihi archaeobotanical array is shown below.

Table 2. The Botanical Assemblage of site 26Ek5040 by Flotation Weight (g) and Number of Appearances (#).

	Feat 33 (N=1)		Feat 34 (N=5)		Feat 39 (N=2)		Feat 40 (N=1)		Feat 41 (N=1)		Total (N=10)	
	g	#	g	#	g	#	g	#	g	#	g	#
Hardwood (99%)												
Sage	0.03	1	<0.01	4	<0.01	2	0.01	1			0.04	8
Other wood			<0.01	1	<0.01	1					<0.01	2
Other Tissue (1%)												
Seeds, 13	<0.01	1	<0.01	3	<0.01	1					<0.01	5
Grass	<0.01	1	<0.01	3	<0.01	1	<0.01	1			<0.01	6
Monocot stem			<0.01	1					<0.01	1	<0.01	2
Herbaceous stem			<0.01	2					<0.01	1	<0.01	3
Root			<0.01	2	<0.01	1	<0.01	1	<0.01	1	<0.01	5
Paryenchymoid			<0.01	1							<0.01	1
Epithelioid			<0.01	2							<0.01	2
Total	0.03		<0.01		<0.01		0.01		<0.01		0.04	34

Hardwood

Hardwoods contribute 99 percent of the assemblage weight. Two hardwood species are represented: sagebrushbrush (*Artemisia* sp.), and an hardwood which cannot further identified. A little sagebrush appears in 80 percent of the samples, and it is clearly the most important taxon at the site.

Other Tissue

Grass stem tissue is second most important plant at the site. Six flots have a grass tissue. In addition, some of the monocot tissue may be grass tissue. Several samples have herbaceous root and stem tissue from basal area of plants. Two samples contained three tiny charred lily family bulbs, approximately 5 to 7 mm tall, and 3 mm in diameter. This suggests floral burning in place, as might be the case under wildfire conditions.

Seeds

The flotation array contains at least 14 seeds from two features (Feature 34 and Feature 39). There are at least 5 goosefoot or chenopodium (*Chenopodium* spp.) seeds present (Table 3). Two species are represented: a larger one, approximately 1.3 mm in diameter with slightly rugulose surface coat; and, a smaller one, 0.9 mm in diameter with a oval to compressed oval outline. Both appear without adherent chaffy coat (the pericarp)--an important diagnostic trait. The two most likely candidates are Fremont' goosefoot (*C. fremontii*) for the first, and linear-leafed goosefoot (*C. leptophyllum*) for the last.

The array has two plantago (*Plantago* sp.) seeds, a large bunchgrass seed (*Festuca/Agropyron* sp. likely), two grass seeds which could not be further identified, a chickweed (*Stellaria* sp.) seed, a tiny legume seed (locoweed, *Astragalus* probably), and portions of two seed coats from two other plant taxa.

Table 3. Seed Identifications.

	Feature 34 upper fill	Feature 34 middle fill	Feature 34 lower fill	Feature 39	Total
Goosefoot (*Chenopodium* spp.)			5		5
Plantago (*Plantago* sp.)	1		1		2
Bunchgrass (*Agropyron/Festuca* sp.)	1				1
Grass seeds			1	1	2
Chickweed (*Stellaria* sp.)	1				1
Locoweed (*Astragalus* sp.)			1		1
Unidentified seeds			2		2
Totals	3	0	10	1	14

The array has two seeds which may be considered edible: the seeds of large bunch grass (wheatgrass, *Festuca* and *Agropyron* sp.), and the larger of the two chenopods species.

Fowler mentions that wheatgrass was collected by the northern Paiute (1986:76). Ray lists bunchgrass among food and fiber plants gathered by the Modoc (1963: 218-219), although he does not mention these particular genera by name. This is understandable because these genera are hard to distinguish on the basis of incomplete seeds.

Chenopodium seeds are common in central Nevada flora. Since some chenopodium species are weedy and prefer disturbed habitats, fresh seeds from plants blown into the site could be charred accidentally. In this case, the charring may be accidental. Four seeds is not enough to posit deliberate collection.

Summary

The feature samples from 26Ek5040 have a low taxal diversity and exceedingly low carbon content (the latter is affected by pre-sorting for radiocarbon assay). At least one woody fuel (sagebrush) is present in nearly every sample. This may be associated with lithic heat-treatment, cooking, casual warming, or brushfires.

There not much in the array that could be considered edible in faunal or floral categories. There is very little burned or calcined bone present. Two seeds (bunch grass and chenopod) that could be considered edible may be intrusive. The lily family roots, are too small to be considered objects of deliberate collection.

The seeds indicate fires at the site occured in summer.

Sample Analysis

A description of each sample follows, and comments are added where appropriate. The samples are uniformly 99% sagebrush with traces of seeds and other tissues present. Identifiable seeds were recovered from only two features, all but one derived from Feature 34 (interpreted during excavation as a small pit hearth, see Chapter 3, this volume).

Feature 33

A single flotation sample (Q5-2.3.3.) produced 0.5 g of archaeobotanical materials from matrix for a carbon content of 0.08% The archaeobotanical array is 100% sagebrush by weight. The sample shows signs of moderate modern bioturbation. Charcoal was removed from the sample for a radiocarbon dating. The carbon content is under-represented in this flot, again it was pre-sorted for radiocarbon assay.

Feature 34

There are five samples from this feature which weighed 15.2 kg. The samples contained 0.57 g of charred material, for a very low carbon content of 0.0004% (mostly removed by hand). Most samples are replete with modern rootlets, insect, and floral dissemules, and bioturbation is severe.

The feature is associated with a date of 850±200 BP.

Upper Feature Fill

A flotation sample from the first 5 cm of the feature fill matrix (AM2-1.1.1.) also contained little charcoal. There are three taxa represented: sagebrush, another hardwood which could not be identified, and a grass caryopsis (*Agropyron/Festuca* sp.).

Past and present bioturbation is heavy, and it includes burned and unburned insect dissemules, sagebrush wood, unburned grass, and several fresh weed seeds.

A second sample from the top of the feature (AM2-1.1.2) had little charcoal. At least five taxa were identified. The sample contains sagebrush, a plantago seed, a chickweed seed, two tiny lily family roots, as well as herbaceous stem tissue and monocot stem and rhizomes.

Moderately heavy bioturbation is indicated by charred and uncharred insect dissemules, grass, modern uncharred seeds, and a few bits of uncharred bone which are likely from a small mammal or rodent.

Middle Feature Fill

The feature sample (AM1-3.3.1) from Level 3, had 0.04 g of charred materials pulled by hand, for a charcoal content of 0.001%. Grass stem was identified. Moderate bioturbation is indicated by modern insect and floral dissemules.

Another sample also from feature fill (AM1-3.4.1) has less charcoal than the sample above, 0.02 gram s of charcoal. Charcoal for dating has been removed so that its frequency is underestimated. The sample has traces of sagebrush and herbaceous stem tissue. Moderate bioturbation is indicated by modern floral and insect dissemules.

Lower Feature Fill

This sample (AM1-3.5.1.) was sorted before arrival, and charcoal has been removed for dating. Approximately 0.37 g was recovered. This is a high amount for the site. There are a minimum of 7 taxa present for an excellent taxal yield of 3.2.

Plants present include sagebrush, grass stem tissue, a grass seed which cannot be further identified (it is not Ag/Fe), a small lily family root (same as the two above), a plantain seed, a partial legume seed (locoweed, probably *Astragalus* sp.), a minimum of four large chenopod seeds (two coats, and two embryos), a second small chenopod seed, two partial seeds fragments which cannot be further identified, and traces of paryenchymoid and epitheloid tissues. Bioturbation is moderately low.

The sample looks as if most of the charred material is charred local floral material which may have been incorporated in the feature by accident. All the seeds are weedy, and the edible seeds (larger chenopods) are not present in sufficient numbers to indicate consumption.

Feature 39

A sample from the top of the feature (An1-1.2.1) with 0.04 g of pulled charcoal for a content of 0.001%. The sample has traces of sagebrush twigs, other hardwood, and grass stem, a grass seed, and rhizome tissue.

There is unburned bone, including fragments of tiny rodent (?) vertebrae. Evidence of bioturbation is heavy and consists of modern insect and floral dissemules.

Sample An1-3.2.1., has 0.04 g of charcoal; sagebrush is present.

Feature 40

The flotation sample from this feature (MS7A-1.2.1) has an estimated charcoal content of 0.03% from a standard subsample. The material is 99% sagebrush by weight, with a trace of herbaceous stem and grass tissue. Bioturbation is moderate.

Feature 41

Sample MS7B-1.1.1 has 0.01 g of charred material. Monocot (some may be grass) tissue and herbaceous stem and root tissue are present. Bioturbation is moderate.

Sources Cited

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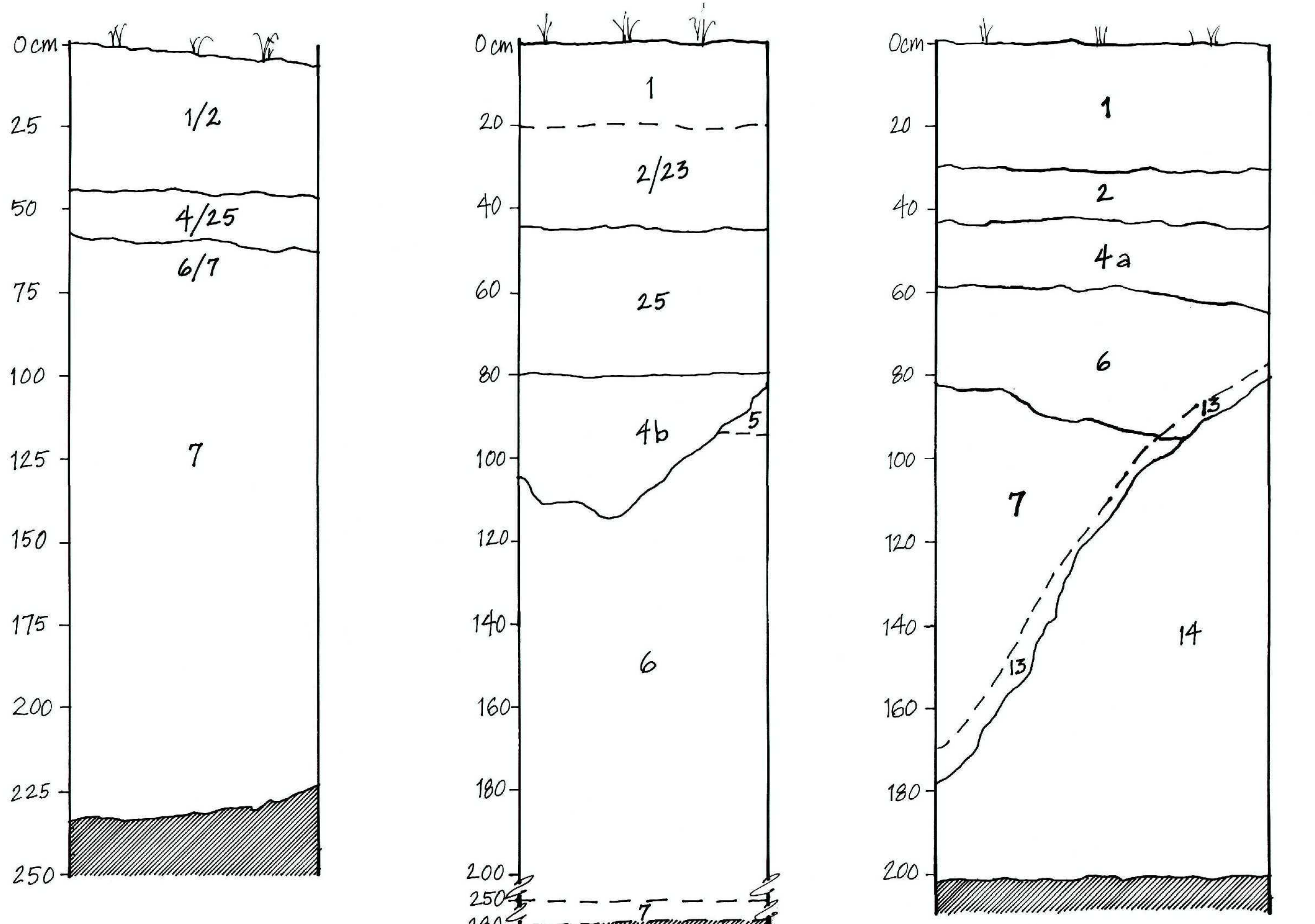
1986 Subsistence. In*Great Basin*, ed. Warren L. d'Azevedo, pp. 64-97. Handbook of North American Indians, vol 11. William G. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Ray, Verne F.
1963 *Primitive Pragmatists: The Modoc Indians of Northern California*. Seattle: University of Washington Press.

Appendix H

Stratigraphic Profiles



a. Trench A, north wall.

b. Trench B, north wall.

c. Trench c, north wall.

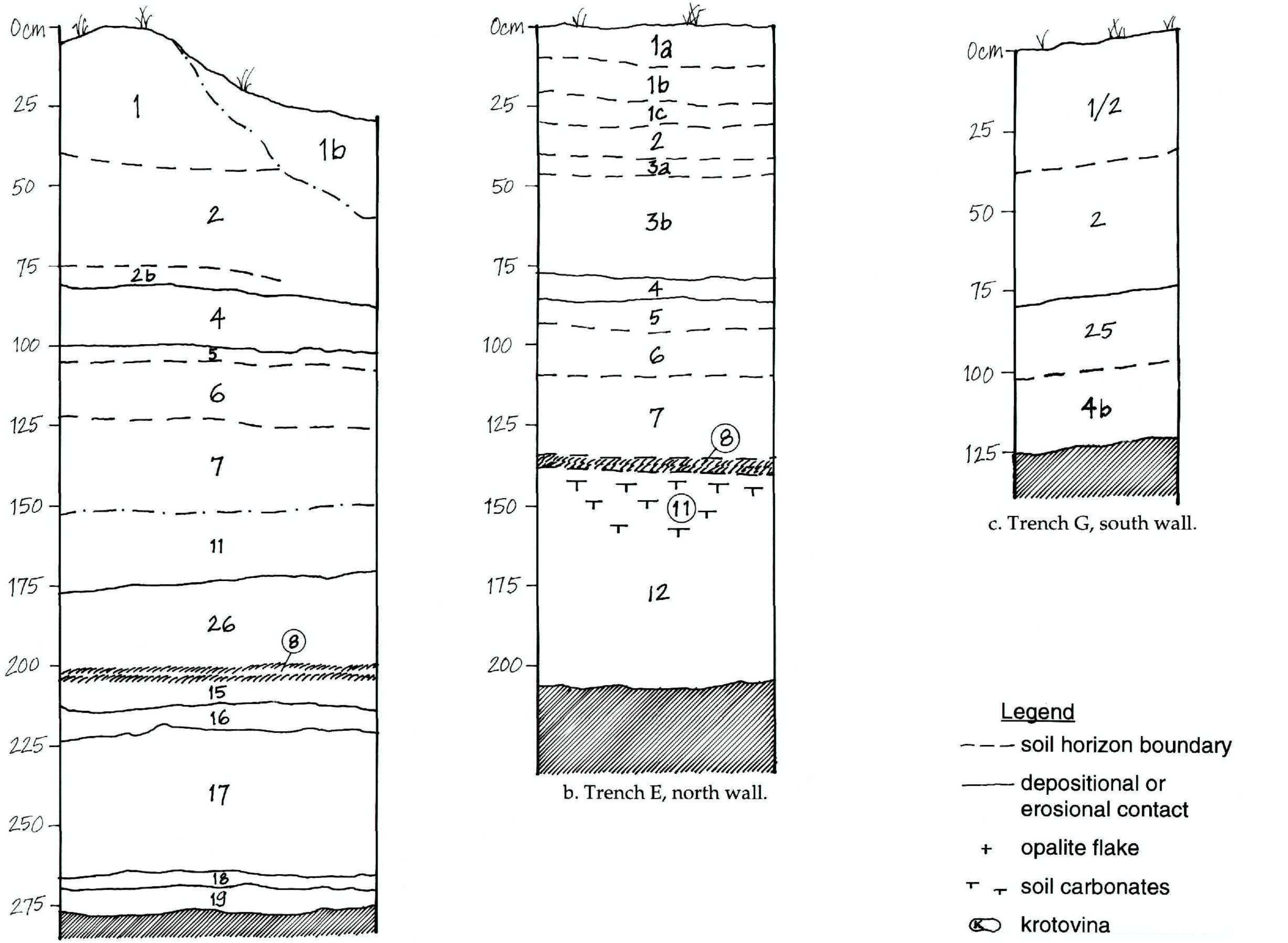
Legend

- - - soil horizon boundary

—— depositional or erosional contact

4a numbers refer to soil descriptions found in Table 2

Figure H.1. Selected trench profiles.

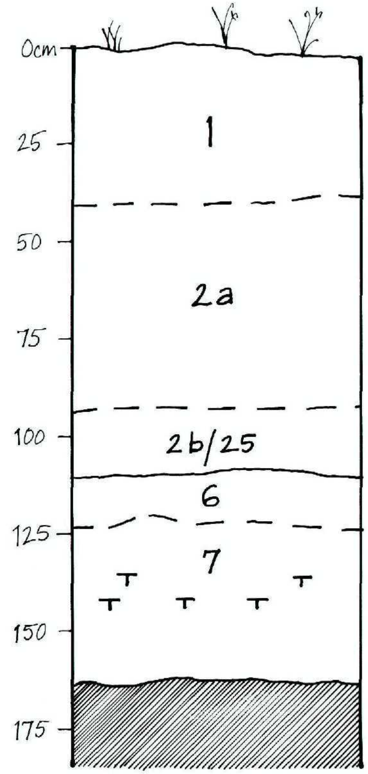


a. Trench D, northwest wall.

b. Trench E, north wall.

c. Trench G, south wall.

Figure H.2. Selected trench profiles.



a. Trench H, north wall.

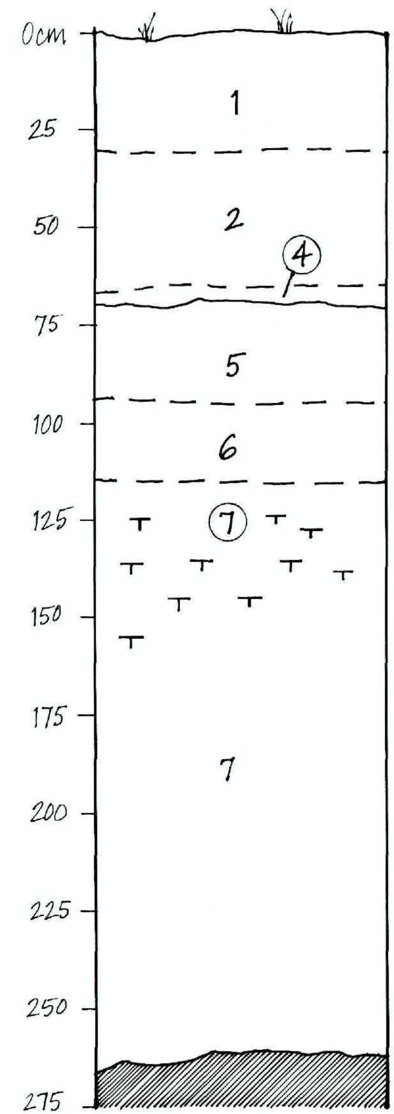
Legend

- - - soil horizon boundary

—— depositional or erosional contact

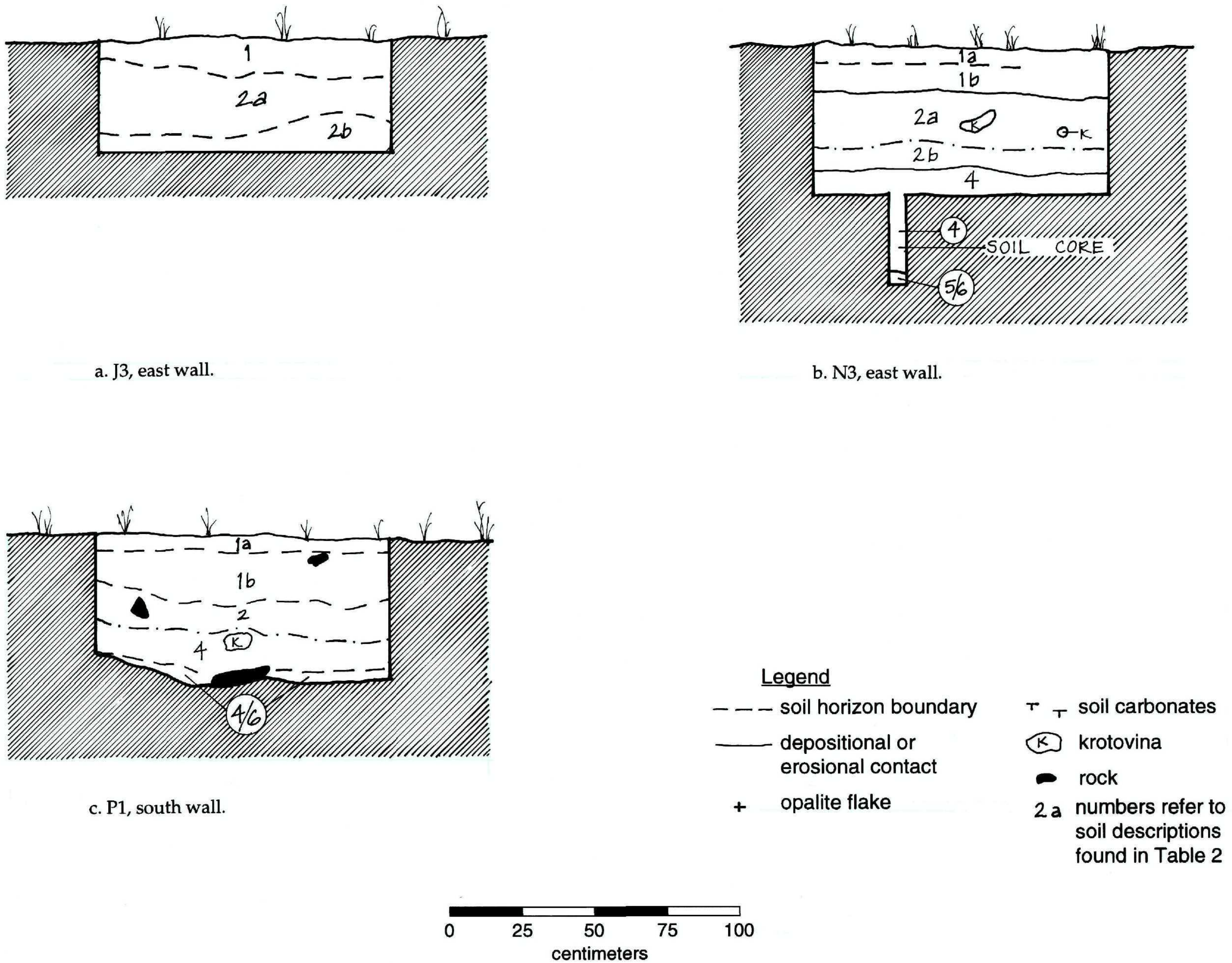
⊤ ⊤ soil carbonates

2a numbers refer to soil descriptions found in Table 2



b. Trench I, north wall.

Figure H.3. Selected trench profiles.

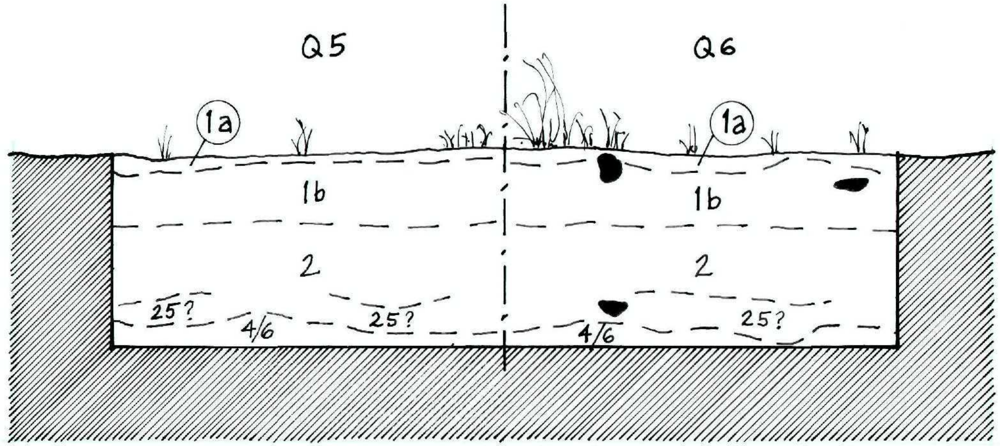


a. J3, east wall.

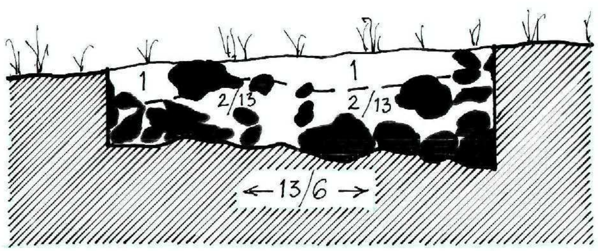
b. N3, east wall.

c. P1, south wall.

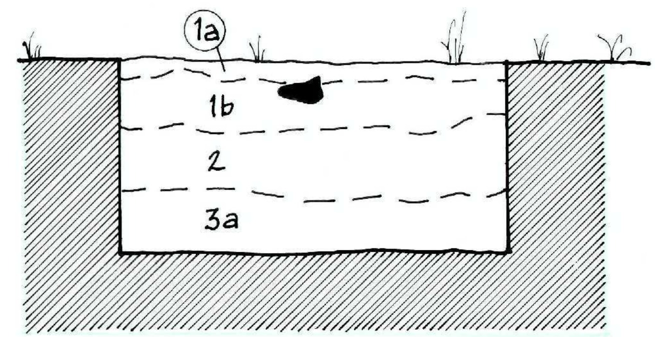
Figure H.4. Unit profiles.



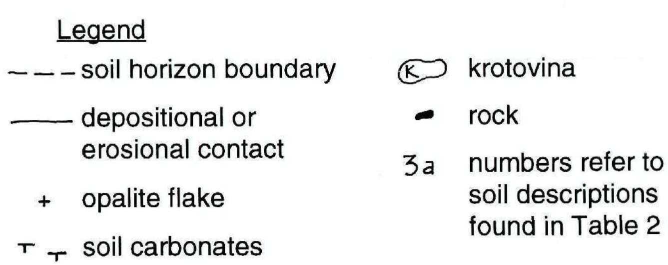
a. Q5, Q6, north wall.



b. R2, east wall.



c. S2, north wall.



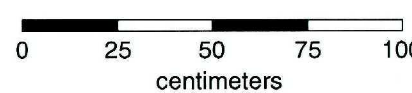


Figure H.5. Unit profiles.

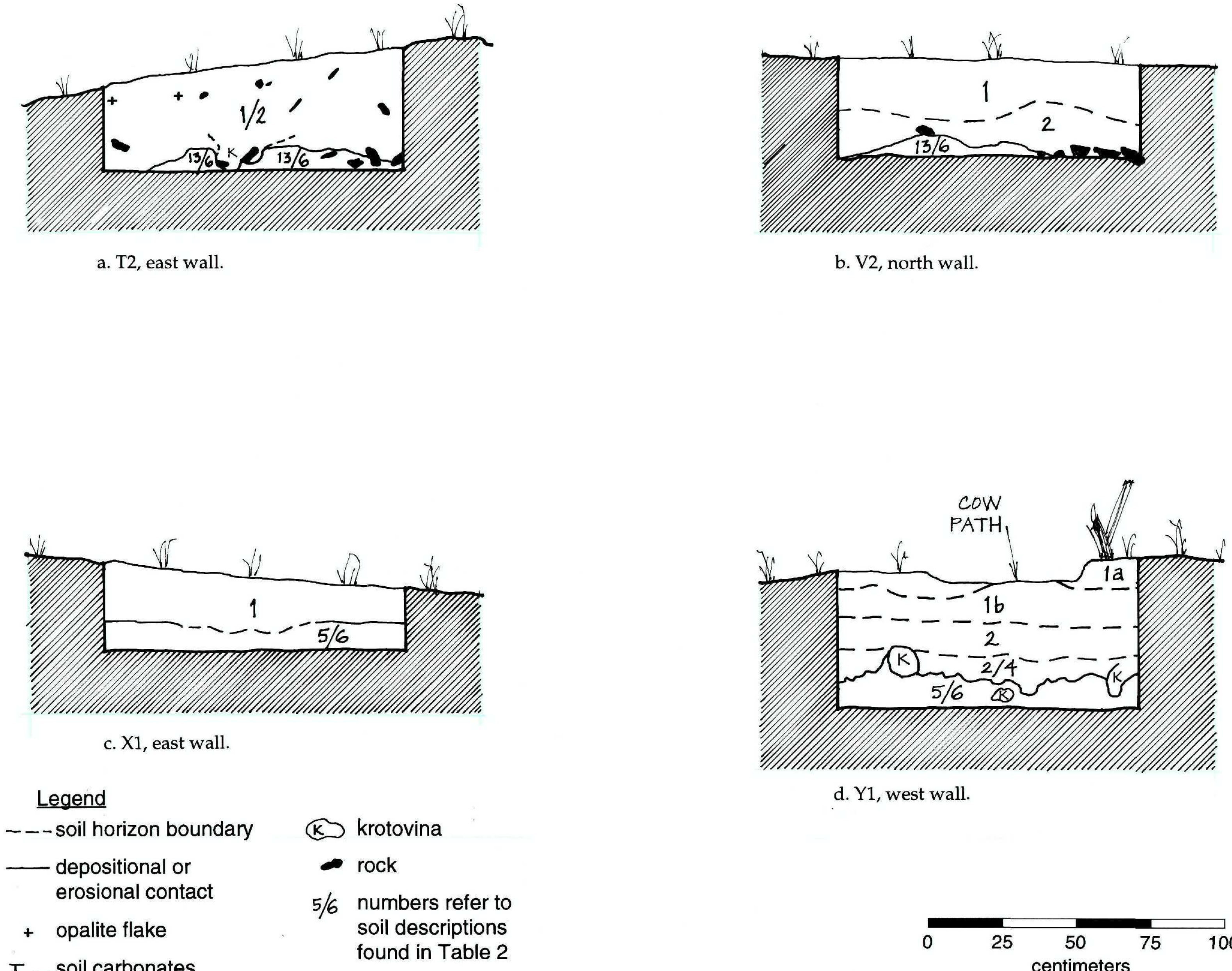
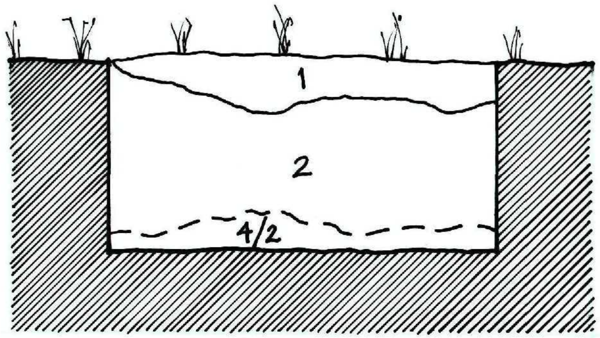
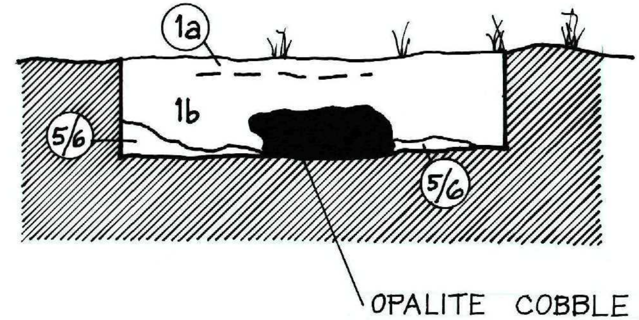


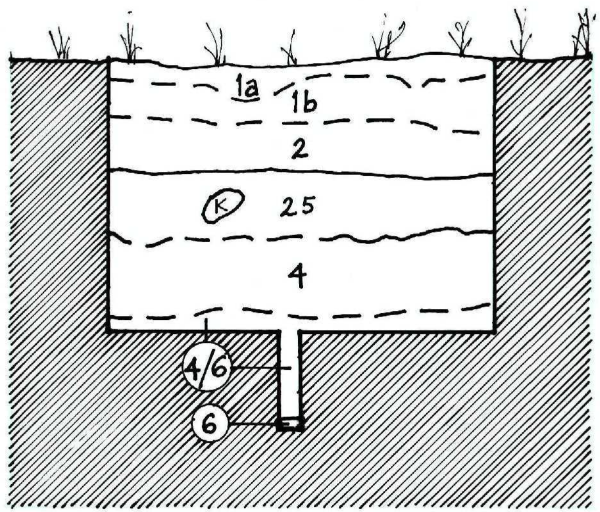
Figure H.6. Unit profiles.



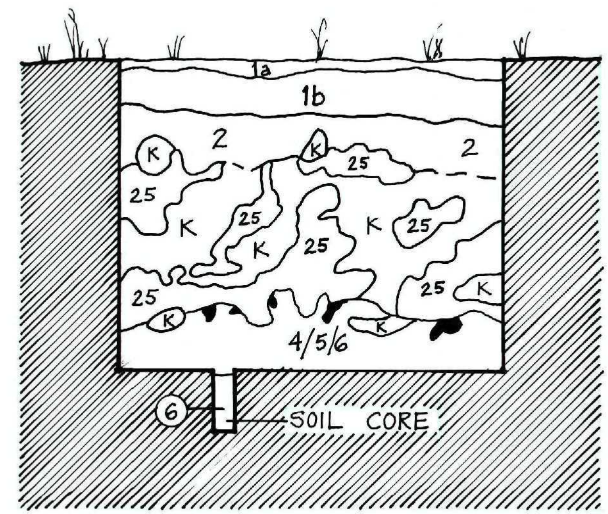
a. AE2, west wall.



b. AF1, north wall.



c. AG1, west wall.



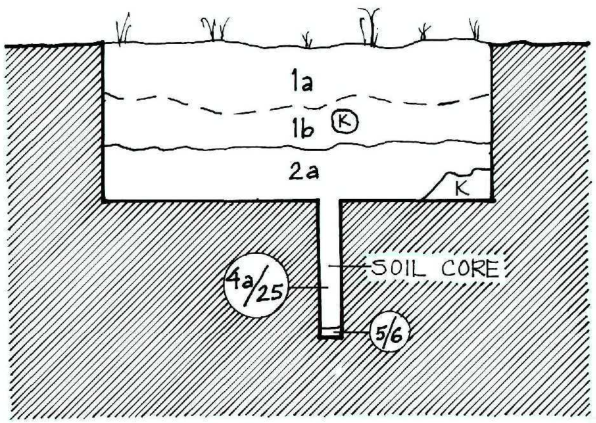
d. AH2, east wall.

0 25 50 75 100
centimeters

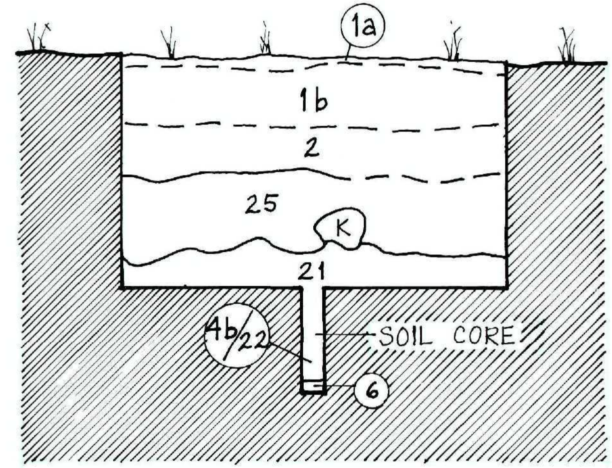
Figure H.7. Unit profiles.

Legend

- – – soil horizon boundary
- —— depositional or erosional contact
- \+ opalite flake
- ⊤ soil carbonates
- K krotovina
- rock
- 1b numbers refer to soil descriptions found in Table 2



a. AI1, east wall.



b. AJ1, north wall.

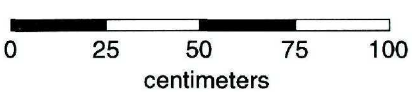


Figure H.8. Unit profiles.

Legend

- – – – soil horizon boundary
- —— depositional or erosional contact
- \+ opalite flake
- ┬ ┬ soil carbonates
- (K) krotovina
- rock
- 2 a numbers refer to soil descriptions found in Table 2

Appendix I

Soil Core Stratigraphy

December 6, 1994

Soil Core Stratigraphy at 26Ek5040

Soil Core	Depth (BS)	Stratum
SC-1	0-30 cm	1
	30-45	25
	45-70	24/4b
	70-105	21
	105-110	21/5
	110-125	5
	125-135 TD	6
SC-2	0-30 cm	1
	30-70	2/4/23/5/6? (bioturbated)
	70-76 TD	7?
SC-3	0-25 cm	1
	25-40	2/23
	40-55	25?/24
	55-85 TD	5
SC-4	0-25 cm	1
	25-37 TD	5
SC-5	0-20 cm	1
	25-35	2a
	35-45	3a
	45-65	3b
	65-70	4a
	70-80 TD	5
SC-6	0-30 cm	1
	30-40	2
	40-53	25
	53-62	4a
	62-66	5
	66-77 TD	6
SC-7	0-10 cm	1
	10-30	2
	30-38	25
	38-65	5/6/7
	65-68	tuff clast
	68-71	6/7
	71-73	tuff clast
	73-90 TD	7

SC-8	0-23 cm	1
	23-30	2
	30-52	23
	52-60	25?
	60-63	24
	63-69	21
	69-72 TD	5
SC-9	0-8 cm	1
	08-29	2
	29-46	25
	46-51	24
	51-68	21
	68-73 TD	5/6
SC-10	0-24 cm	1
	24-38	2(1c)
	38-50	3a/3b
	50-65	4b
	65-73 TD	5/6
SC-11	0-22 cm	1
	22-40	2
	40-50	3b?
	50-60	4b?
	60-65	5/6
	65-86 TD	7?
SC-12	0-20 cm	1/2a
	20-41	2b
	41-45	5/6
	45-59 TD	7
SC-13	0-36 cm	1
	36-60	2
	60-76	25?
	76-90	4a
	90-105 TD	6/7
SC-14	0-28 cm	1
	28-50	2
	50-65 TD	23?
SC-15	0-27 cm	1
	27-38	2
	38-136	25
	136-142 TD	6
SC-16	0-29 cm	1
	29-35	2
	35-68	25
	68-74 TD	4a?/25

SC-17	0-28 cm	1
	28-40	2
	40-75	4a/25
	75-80	4
	80-85 TD	6
SC-18	0-25 cm	1/2
	25-30	2/4b
	30-32 TD	6
SC-19	0-20 cm	1
	20-45	2
	45-60	23
	60-65	4a/25
	65-80 TD	6
SC-20	0-20 cm	1/2
	20-35 TD	6

Appendix J

Technological Debitage Data

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
0	0	94	8	OB	0	0	0	3	0
0	0	94	21	OB	0	0	0	0	0
0	0	94	28	OB	0	3	0	0	0
0	0	94	35	OB	0	0	0	0	3
0	0	94	43	OB	0	0	3	0	0
0	0	94	63	OB	0	0	0	0	0
0	0	94	68	OB	0	0	0	0	0
0	0	94	83	OB	3	0	0	0	0
0	0	94	93	OB	0	0	3	0	0
0	0	94	141	OB	3	0	0	0	0
0	0	94	143	OB	0	0	0	3	0
0	0	94	144	OB	0	0	0	0	0
0	0	94	145	OB	0	3	0	0	0
0	0	94	146	OB	3	0	0	0	0
0	0	94	148	OB	0	0	0	0	0
0	0	94	149	OB	0	0	0	0	0
0	0	94	151	OB	0	0	0	0	0
0	0	94	152	OB	0	0	0	0	0
0	0	94	156	OB	0	0	0	0	0
0	0	94	157	OB	0	0	0	0	3
0	0	94	164	OB	3	0	0	0	0
0	0	94	166	OB	0	0	0	0	0
0	0	94	186	OB	0	0	0	0	0
0	0	94	231	OB	0	0	0	0	3
0	0	94	233	OB	0	0	0	0	0
0	0	94	243	OB	3	0	0	0	0
0	0	94	244	OB	3	0	0	0	0
0	0	94	245	OB	0	0	0	0	0
0	0	94	246	OB	3	0	0	0	0
0	0	94	247	OB	0	0	0	0	0
0	0	94	249	OB	0	0	0	3	0
0	0	94	250	OB	0	0	0	0	0
0	0	94	258	OB	0	0	0	0	0
3	1	1	3	EX	0	0	0	3	0
3	1	1	4	BA	0	0	0	0	0
AA1	1	1	1	OP	1	2	2	1	1
AA1	1	1	2	CT	1	1	2	1	0
AA2	1	1	2	OP	0	1	3	2	1
AA2	1	1	3	CT	0	0	0	0	1
AA2	1	1	4	BA	0	0	0	0	0
AB1	1	1	1	OP	0	1	3	1	1
AB1	1	1	2	CT	0	0	0	0	0
AB1	1	1	3	BA	0	0	0	0	0
AB1	1	1	4	OB	0	0	0	0	3
AB2	1	1	1	OP	0	2	2	1	0
AB2	1	1	2	CT	0	0	0	0	1
AC1	1	1	1	OP	0	1	1	1	1
AC1	1	1	2	BA	3	0	0	0	0
AC2	1	1	1	OP	0	1	1	2	2
AC2	1	1	2	BA	3	0	0	0	0

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
AD1	1	1	1	OP	0	2	3	2	1
AD1	1	1	2	CT	0	0	1	0	1
AD1	1	1	3	OB	0	0	0	0	3
AD2	1	1	1	OP	0	2	3	2	1
AD2	1	1	2	CT	2	0	0	0	1
AD2	1	1	3	BA	0	0	0	0	0
AD2	1	1	4	OB	0	0	0	0	3
AD3	1	1	1	OP	1	1	2	2	1
AD3	1	1	2	CT	1	1	1	0	1
AD3	1	1	3	BA	0	3	0	0	0
AD3	1	1	4	OB	0	0	0	2	2
AE1	1	1	1	OP	0	1	3	1	1
AE1	1	1	2	CT	0	0	0	0	0
AE2	1	1	1	OP	0	1	3	1	1
AE2	2	1	1	OP	0	1	3	1	1
AE2	3	1	1	OP	0	1	3	2	2
AE2	4	1	1	OP	0	1	2	3	2
AE2	5	1	1	OP	0	0	0	0	0
AE2	5	1	2	CT	0	0	3	0	0
AE2	6	1	1	OP	0	0	0	3	1
AE3	1	1	1	OP	0	1	3	1	1
AF	4	1	1	OP	0	0	0	2	0
AF1	1	1	1	OP	0	0	2	2	0
AF1	2	1	1	OP	0	0	2	3	0
AF1	3	1	1	OP	0	0	2	3	0
AF1	3	1	2	CT	0	0	3	0	0
AF2	1	1	1	OP	0	0	2	2	0
AF3	1	1	1	OP	0	0	0	2	0
AF3	1	1	2	CT	0	0	0	0	0
AG1	1	1	1	OP	0	1	1	1	0
AG1	1	1	2	CT	0	1	0	0	0
AG1	2	1	2	OP	0	1	1	2	2
AG1	2	1	3	CT	0	2	0	1	0
AG1	3	1	1	OP	0	1	2	3	2
AG1	3	1	2	CT	0	1	0	0	0
AG1	3	1	3	BA	0	0	0	0	0
AG1	4	1	1	OB	0	0	0	0	0
AG1	4	1	2	OB	0	0	0	0	3
AG1	4	1	3	OP	0	1	3	2	1
AG1	4	1	4	CT	0	0	0	0	1
AG1	4	1	5	BA	0	0	0	0	0
AG1	5	1	1	OP	0	1	3	2	1
AG1	5	1	2	CT	0	0	0	0	3
AG1	5	1	3	BA	0	0	0	0	0
AG1	6	1	1	OP	0	0	2	2	1
AG1	6	1	2	CT	0	0	2	0	0
AG1	7	1	1	OP	0	1	3	2	1
AG1	8	1	1	OP	0	0	0	0	0
AG1	8	1	2	CT	0	0	0	0	3
AG2	1	1	1	OP	0	0	0	1	1

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
AH1	1	1	1	OP	0	1	1	2	0
AH1	1	1	2	CT	0	0	0	0	0
AH2	1	1	1	OP	0	2	2	2	0
AH2	2	1	1	OP	0	0	1	3	0
AH2	2	1	1	OB	0	0	0	0	3
AH2	2	1	2	CT	0	0	0	0	0
AH2	3	1	1	OP	0	2	3	1	0
AH2	3	1	2	CT	0	2	0	0	0
AH2	4	1	1	OP	1	3	1	1	0
AH2	4	1	2	CT	0	0	0	0	0
AH2	5	1	1	OP	0	0	2	0	0
AH2	6	1	1	OP	0	2	2	2	1
AH2	6	1	2	BA	0	0	0	0	0
AH2	6	1	3	CT	0	0	0	0	0
AH2	7	1	1	OP	0	1	0	2	0
AH2	7	1	2	BA	0	0	0	0	0
AH2	7	1	3	CT	0	2	0	0	0
AH2	7	2	1	OP	0	0	1	0	0
AH2	7	2	2	CT	0	1	1	1	0
AH2	8	1	1	OP	0	1	3	1	0
AH2	9	1	1	OP	0	1	2	2	0
AH2	10	1	1	OP	0	1	2	1	1
AH2	10	1	2	CT	1	0	0	0	0
AI1	1	1	1	OP	0	0	0	0	0
AI1	1	1	2	CT	0	0	0	0	0
AI1	2	1	1	OP	0	1	0	3	0
AI1	3	1	1	OP	0	1	1	3	0
AI1	4	1	1	OP	0	0	0	3	0
AI1	5	1	1	OP	0	1	0	1	0
AJ1	1	1	1	OP	0	1	2	1	0
AJ1	2	1	1	OP	0	1	1	2	0
AJ1	3	1	1	OP	0	1	2	3	1
AJ1	3	1	2	CT	0	0	0	0	0
AJ1	4	1	1	OB	0	3	0	0	0
AJ1	4	1	2	OP	0	0	1	3	0
AJ1	4	1	3	CT	0	0	0	0	0
AJ1	5	1	2	OB	0	0	0	0	0
AJ1	5	1	3	OP	0	0	1	3	1
AJ1	5	1	4	CT	1	1	0	0	0
AJ1	6	1	1	OP	0	1	3	2	0
AJ1	7	1	1	OP	0	2	0	1	0
AJ1	7	1	2	CT	0	2	0	0	0
AK1	1	1	1	OP	0	1	1	0	0
AK1	2	1	1	OP	0	0	2	2	1
AK1	3	1	1	OP	0	1	3	2	2
AL1	1	1	1	OP	0	1	1	1	1
AL1	1	1	2	CT	0	0	1	0	0
AL1	2	1	1	OP	0	0	1	3	1
AL1	2	1	3	CT	0	0	1	0	0
AL1	3	1	1	OP	0	0	1	3	1

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
AL1	3	1	3	CT	0	0	3	0	0
AL1	4	1	1	OP	0	1	2	3	2
AL1	4	1	1	OB	0	0	0	0	0
AL1	4	1	2	OB	0	0	0	0	3
AL1	4	1	5	CT	1	1	0	0	0
AL1	5	1	1	OP	2	2	2	1	1
AL1	5	1	2	CT	0	0	0	0	0
AL1	6	1	1	OP	0	1	1	3	1
AL1	6	1	2	CT	0	2	0	0	0
AL1	7	1	1	OP	1	1	1	3	1
AL1	7	1	4	CT	0	0	0	1	0
AL1	8	1	1	OB	0	0	0	0	3
AL1	8	1	2	OP	0	2	1	3	0
AL1	8	1	4	CT	0	0	0	0	1
AM1	1	1	1	OP	1	0	2	2	1
AM1	1	1	2	CT	0	2	1	0	0
AM1	2	1	1	OP	0	1	1	1	0
AM1	3	1	1	OP	1	2	2	2	2
AM1	3	1	4	CT	0	2	0	0	0
AM1	3	2	1	OP	0	0	2	1	1
AM1	3	2	2	CT	0	3	0	0	0
AM1	4	1	1	OB	0	0	0	0	0
AM1	4	1	4	CT	2	2	2	0	0
AN1	1	1	1	OP	0	2	3	2	1
AN1	1	1	3	CT	0	1	0	0	3
AN1	1	1	4	OB	0	0	0	0	3
AN1	2	1	1	OP	0	2	3	2	1
AN1	2	1	7	CT	0	1	0	0	0
AN1	3	1	1	OP	1	2	2	3	1
AN1	3	1	17	CT	0	2	2	2	0
AN1	3	1	19	BA	0	0	0	0	0
AN1	3	1	20	OB	0	0	0	0	3
AN1	4	1	1	OB	0	3	0	0	0
AN1	4	1	2	OB	0	0	0	0	3
AN1	4	1	3	OB	0	0	0	0	0
AN1	4	1	4	OP	1	2	2	2	0
AN1	4	1	11	CT	0	0	0	0	3
J1	1	1	1	OP	0	1	3	2	2
J2	1	1	1	OP	0	0	2	1	0
J3	1	1	1	OB	0	0	0	0	3
J3	1	1	2	OP	0	1	0	1	0
J3	2	1	1	OP	0	0	0	3	0
J3	3	1	1	OP	0	0	0	2	1
J3	3	1	2	CT	0	0	0	3	0
J3	4	1	1	OP	0	0	0	2	0
J3	5	1	1	OP	0	1	1	2	0
K1	1	1	1	OB	0	0	3	0	0
K1	1	1	2	OP	0	0	1	1	1
K2	1	1	1	OP	0	0	0	0	0
K3	1	1	1	OP	0	1	2	1	0

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
K3	1	1	2	CT	0	0	0	3	0
L1	1	1	1	OB	0	0	0	0	3
L1	1	1	2	OP	0	1	1	1	2
L1	1	1	3	CT	0	0	0	0	0
L2	1	1	1	OB	0	0	0	3	0
L2	1	1	2	OB	0	0	0	3	0
L2	1	1	3	OP	0	0	0	1	3
L2	1	1	4	CT	1	0	0	0	0
L3	1	1	1	OB	0	0	0	0	3
L3	1	1	2	OP	0	0	2	1	2
L3	1	1	3	CT	0	0	1	0	0
L3	1	1	3	OB	0	0	0	0	3
L4	1	1	2	OP	0	0	1	1	2
L4	1	1	3	CT	3	0	0	0	0
M1	1	1	1	OP	0	2	2	2	0
M2	1	1	1	OP	0	1	2	3	1
MS7A	1	1	1	OB	0	0	0	0	3
MS7A	1	1	2	OP	0	2	2	2	0
MS7A	1	1	3	CT	0	2	0	2	1
MS7B	1	2	1	OP	0	1	2	2	0
MS7B	1	2	2	CT	0	0	0	1	2
MS7B	1	2	3	BA	0	0	0	0	0
N1	1	1	1	OP	1	2	2	1	1
N2	1	1	1	OP	1	2	2	3	1
N3	1	1	1	OP	1	2	2	3	1
N3	2	1	1	OB	0	0	0	3	0
N3	2	1	3	OP	0	2	1	2	0
N3	3	1	1	OP	1	1	2	3	1
N3	4	1	2	CT	0	1	0	0	0
N3	5	1	1	OP	0	1	1	1	1
N3	5	1	2	EX	0	0	0	3	0
N3	6	1	1	OP	0	0	0	2	2
O	0	94	81	OB	0	0	0	0	3
O	0	94	147	OB	3	0	0	0	0
O1	1	1	1	OP	0	1	1	2	2
O2	1	1	1	OP	1	0	2	1	1
O2	1	1	2	CT	0	1	0	1	2
O3	1	1	1	OP	1	2	2	2	1
O3	1	1	2	CT	2	2	1	0	0
P1	1	1	1	OP	1	2	2	1	1
P1	1	1	7	CT	0	0	0	0	0
P1	2	1	1	OP	1	1	2	2	1
P1	2	1	3	CT	2	0	0	1	0
P1	3	1	1	OB	0	0	0	2	0
P1	3	1	2	OP	1	1	2	3	2
P1	3	1	5	CT	0	2	2	2	2
P1	4	1	1	OB	0	0	0	1	2
P1	4	1	2	OB	0	0	0	0	0
P1	4	1	4	OP	1	1	2	3	2
P1	4	1	9	CT	0	3	2	1	2

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
P1	5	1	1	OB	0	0	0	0	0
P1	5	1	3	OP	0	2	1	3	1
P1	5	1	6	CT	1	0	2	2	1
P1	6	1	1	OP	0	1	1	3	1
P1	6	1	2	CT	0	1	1	0	0
P2	1	1	1	OB	0	0	0	2	2
P2	1	1	3	CT	0	0	0	0	2
P3	1	2	2	CT	0	0	0	0	1
Q1	1	1	1	OB	0	0	0	0	3
Q1	1	1	2	OB	0	0	0	0	3
Q1	1	1	3	OP	1	2	2	2	1
Q1	1	1	4	CT	0	0	0	0	1
Q2	1	1	1	OP	1	2	2	1	1
Q2	1	1	2	CT	0	0	0	0	0
Q3	1	1	1	OP	0	1	3	1	1
Q3	1	1	6	CT	1	1	1	0	0
Q4	1	1	1	OB	0	0	0	0	3
Q4	1	1	2	OP	1	1	3	1	1
Q4	1	1	4	CT	0	0	0	2	0
Q5	1	2	1	OB	0	0	0	2	0
Q5	1	2	2	OB	3	0	0	0	0
Q5	1	2	3	OP	1	1	2	2	1
Q5	1	2	10	CT	0	2	1	0	1
Q5	2	1	1	OB	0	0	0	0	3
Q5	2	1	2	OP	1	1	2	1	1
Q5	2	1	3	CT	0	1	0	2	0
Q5	3	1	1	OB	0	0	0	3	0
Q5	3	1	2	OP	2	2	3	2	2
Q5	3	1	7	CT	1	2	2	0	0
Q5	4	1	2	OP	1	2	2	2	2
Q5	4	1	5	CT	0	2	2	3	2
Q5	5	1	1	OB	0	0	0	0	0
Q5	5	1	2	OB	3	0	0	0	0
Q5	5	1	3	OB	3	0	0	0	0
Q5	5	1	4	OP	2	2	2	2	1
Q5	5	1	7	CT	0	2	1	2	1
Q5	6	1	1	OB	0	0	0	0	0
Q5	6	1	2	OB	0	0	0	3	0
Q5	6	1	3	OP	1	2	1	2	1
Q5	6	1	7	CT	1	0	0	0	1
Q6	1	1	1	OB	0	0	0	3	0
Q6	1	1	2	OB	0	0	0	0	0
Q6	1	1	3	OB	0	0	0	3	0
Q6	1	1	4	OB	0	0	0	0	0
Q6	1	1	5	OB	0	0	0	0	3
Q6	1	1	6	OP	0	1	2	1	1
Q6	1	1	17	CT	0	1	0	1	0
Q6	2	1	1	OP	2	1	2	1	1
Q6	2	1	3	CT	0	0	0	0	1
Q6	3	1	1	OB	3	0	0	0	0

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
Q6	3	1	2	OB	0	3	0	0	0
Q6	3	1	3	OP	1	1	2	3	2
Q6	3	1	11	CT	0	3	1	1	1
Q6	4	1	1	OB	3	0	0	0	0
Q6	4	1	2	OB	0	0	0	0	3
Q6	4	1	3	OP	2	2	1	2	2
Q6	4	1	15	CT	0	3	0	2	0
Q6	5	1	1	OB	0	0	0	0	0
Q6	5	1	2	OB	0	0	0	0	3
Q6	5	1	3	OB	0	0	0	0	0
Q6	5	1	4	OP	2	2	2	1	1
Q6	5	1	6	CT	1	2	1	2	1
Q6	5	1	6	BA	0	0	0	0	0
Q6	6	1	1	OB	0	0	0	0	3
Q6	6	1	2	OB	0	0	0	0	0
Q6	6	1	3	OB	0	0	0	0	3
Q6	6	1	4	OB	0	0	0	0	3
Q6	6	1	5	OB	0	0	0	0	0
Q6	6	1	6	OB	0	0	0	0	0
Q6	6	1	7	OB	0	0	0	0	3
Q6	6	1	8	OP	0	1	2	2	1
Q6	6	1	11	CT	0	0	0	3	0
Q7	1	1	1	OP	0	1	2	2	1
Q7	1	1	5	CT	0	1	0	2	0
Q7	2	1	1	OB	0	0	0	0	0
Q7	2	1	2	OB	0	0	0	0	0
Q7	2	1	3	OB	0	0	0	3	0
Q7	2	1	4	OB	0	0	0	0	0
Q7	2	1	5	OP	1	2	1	3	1
Q7	2	1	8	CT	0	2	2	1	1
Q7	3	1	1	OP	1	1	1	3	1
Q7	3	1	7	CT	0	0	1	2	0
Q7	4	1	1	OB	3	0	0	0	0
Q7	4	1	2	OP	1	1	1	2	1
Q7	4	1	7	CT	0	2	1	2	3
Q7	4	1	10	BA	0	3	0	0	0
Q7	5	1	1	OB	0	0	0	0	3
Q7	5	1	3	OB	0	0	0	0	0
Q7	5	1	4	OB	0	0	0	0	3
Q7	5	1	5	OP	1	2	2	3	1
Q7	5	1	11	CT	1	2	2	2	2
Q7	5	1	13	BA	3	0	0	0	0
Q8	1	1	1	OB	0	0	0	3	0
Q8	1	1	2	OP	0	3	2	2	1
Q8	1	1	7	CT	0	1	1	1	2
Q8	2	1	1	OB	0	0	0	0	3
Q8	2	1	2	OP	0	1	2	2	1
Q8	3	1	1	OB	0	3	0	0	0
Q8	3	1	2	OB	0	0	0	0	0
Q8	3	1	3	OP	1	2	2	3	1

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
Q8	3	1	3	OB	0	0	0	0	3
Q8	3	1	4	OB	0	0	0	0	0
Q8	3	1	9	CT	0	1	0	1	1
Q8	4	1	1	OB	0	0	0	0	0
Q8	4	1	2	OP	1	2	3	2	1
Q8	4	1	5	CT	0	1	0	1	2
Q8	5	1	1	OB	0	0	0	0	3
Q8	5	1	2	OB	0	0	0	0	3
Q8	5	1	3	OB	0	0	0	0	0
Q8	5	1	4	OB	0	0	0	0	0
Q8	5	1	5	OB	0	0	0	0	3
Q8	5	1	6	OB	0	0	0	0	3
Q8	5	1	7	OP	1	1	1	2	2
Q8	5	1	18	CT	0	1	1	2	2
R1	1	1	1	OB	0	3	0	0	0
R1	1	1	2	OB	0	0	0	0	3
R1	1	1	3	OP	1	2	1	2	1
R1	1	1	4	BA	0	3	0	0	0
R1	1	1	5	CT	3	0	0	0	0
R2	1	1	1	OP	1	1	2	2	1
R2	2	1	1	OP	0	1	2	1	1
R2	3	1	1	OP	1	1	2	1	1
R2	4	1	1	OP	1	0	2	1	1
R2	4	1	2	CT	0	0	0	0	0
R3	1	1	1	OB	0	0	0	0	3
R3	1	1	2	OP	1	1	2	1	1
R4	1	1	1	OP	1	1	2	1	1
R4	1	1	2	CT	2	0	0	0	0
S!	1	1	2	OP	1	1	3	2	1
S1	1	1	1	OB	0	0	0	0	0
S2	1	1	1	OP	1	1	2	2	1
S2	2	1	1	OP	1	1	2	1	1
S2	3	1	1	OP	0	1	2	1	1
S2	4	1	1	OP	1	1	2	1	1
S2	5	1	2	OB	0	0	0	0	3
S2	5	1	3	OB	0	0	0	0	0
S2	5	1	4	OB	0	0	0	0	0
S2	5	1	5	OP	0	0	2	1	1
S2	6	1	1	OP	1	1	2	2	0
S2	6	1	2	OP	0	0	0	0	0
S2	6	1	2	BA	0	0	0	0	0
S3	1	1	1	OP	0	1	2	1	1
T1	1	1	1	OP	1	1	2	1	1
T2	1	1	1	OP	1	1	2	2	1
T2	2	1	1	OP	1	0	2	1	1
T2	3	1	1	OP	1	1	2	2	1
T2	4	1	2	OP	1	1	3	2	1
T2	5	1	1	OB	0	0	0	0	0
T2	5	1	2	OB	3	0	0	0	0
T2	5	1	3	OP	1	1	2	1	1

Unit	Level	Lot	Specimen	Material	Core Reduction	Edge/Blank Preparation	Early Thinning	Late Thinning	Retouch
T3	1	1	1	OP	1	1	2	2	1
U1	1	1	1	OP	1	1	2	1	0
U2	1	1	1	OP	1	1	2	1	1
U2	1	1	2	CT	0	0	0	0	0
U3	1	1	1	OP	1	2	3	2	0
V1	1	1	1	OP	1	1	2	1	1
V2	1	1	1	OB	0	0	0	0	0
V2	1	1	2	OP	1	1	2	2	1
V2	2	1	1	OP	1	1	2	1	1
V2	3	1	1	OP	0	1	2	1	1
V2	4	1	1	OP	0	1	2	2	1
V3	1	1	1	OB	0	3	0	0	0
V4	1	1	1	OB	0	0	0	0	3
V4	1	1	2	OP	1	1	3	1	1
W1	1	1	1	OP	0	1	2	2	1
W2	1	1	1	OP	1	1	2	2	1
W3	1	1	1	OP	0	1	2	2	1
X1	1	1	1	OP	1	2	3	2	0
X1	2	1	1	OP	0	0	2	2	0
X1	3	1	1	OP	0	1	1	3	2
X1	4	1	1	OP	0	2	2	2	0
X2	1	1	1	OP	0	1	2	3	1
X3	1	1	1	OP	0	0	2	3	0
X4	1	1	1	OP	0	1	3	1	1
Y1	1	1	1	OB	0	0	0	3	0
Y1	1	1	2	OB	0	0	0	0	0
Y1	1	1	3	OB	0	0	0	0	3
Y1	1	1	4	OP	0	3	2	1	1
Y1	2	1	1	OP	0	1	3	2	0
Y1	3	1	1	OB	0	0	0	0	3
Y1	3	1	2	OB	0	0	0	0	0
Y1	3	1	3	OB	0	0	0	3	0
Y1	3	1	4	OB	0	0	0	0	0
Y1	3	1	5	OP	1	2	2	2	1
Y1	4	1	1	OB	0	0	0	0	3
Y1	4	1	2	OP	0	1	3	1	1
Y1	5	1	1	OP	1	1	1	3	1
Y1	6	1	1	OP	0	1	2	1	1
Y2	1	1	1	OB	0	0	0	0	0
Y2	1	1	2	OP	0	3	2	1	1
Z1	1	1	1	OB	0	0	0	0	0
Z1	1	1	2	OP	1	1	2	2	0
Z2	1	1	1	OP	1	2	2	1	1

Material Key:
CT=Local Chert; OB=Obsidian; OP=Opalite; EX=Exotic Chert; BA=Basalt